ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

AUGUST, 1982
AUST $2.00 NZ $2.50

CAR COMPUTER

ULTRASONIC RULER TO BUILD

SUPER BASS SUB-WOOFER LOUDSPEAKER

HOW SAFE ARE VIDEO DISPLAYS?

Registered by Australia Post —
publication No. NBP0240.

Walkman is guaranteed worldwide for 90 days under Sony's International Warranty System.

Enter the state of higher fidelity with the new Walkman 2 stereo player, the world's smallest HiFi. It's a sensational way to listen to music on cassettes and raise your awareness of sound. Walkman is so light it practically feels weightless. So small it's hardly bigger than the plastic case that cassettes come in. And so personal, with headphones that weigh next to nothing, that HiFi has never been more intimate.
The new Sony Walkman. It can make your experience of sound infinitely wondrous.

The World's Smallest HiFi

WALKMAN

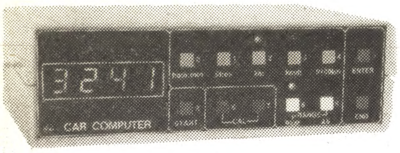
Walkman is a registered trade name of Sony.

SON 0114

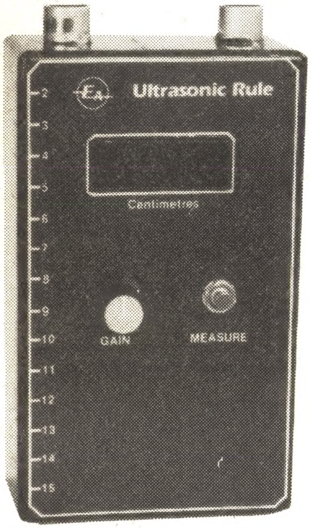
ELECTRONICS AUSTRALIA

Volume 44, No. 8
August, 1982

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE



The second article on our Car Computer has the full circuit and construction details. Turn to page 40.



This handy gadget uses ultrasonic waves to electronically measure distances of up to seven metres. For details see page 76.

COMING NEXT MONTH — Find out what's coming by turning to page 110.

On the cover

This month's front cover highlights the Car Computer. Build one for your car and get immediate feedback on fuel consumption and other vital parameters. See above and page 40. (Photograph by Warren Webb).

FEATURES

HEALTH HAZARDS OF VDUs *What are the facts?* 12
AUSTRALIA'S PART IN STARLAB *Telescope in orbit* 18
50 AND 25 YEARS AGO *Interesting items from past issues* 125

HIFI, VIDEO AND REVIEWS

AUSTRALIAN SYNTHESISER FOR WORLD MARKET 30
HIFI REVIEW *Phonic SA-3000 stereo graphic equaliser* 36

PROJECTS AND CIRCUITS

CAR COMPUTER: PART 2 *Circuit and construction details* 40
100W SUB-WOOFER ENCLOSURE *For extended bass response* 54
ULTRASONIC RULE *Measures distance electronically* 76

PERSONAL COMPUTERS

SHIELDING FOR THE SYSTEM-80 *End interference problems* 86
ADDING GRAPHICS TO THE SUPER-80 *Kit review and program* 88
HOW TO PROGRAM IN MACHINE LANGUAGE *Concluding our series* 94
MICROCOMPUTER NEWS *Report on NCC '82* 126

COMMUNICATIONS

MARC NR82 MULTIBAND RECEIVER *Coverage to UHF* 22
SHORTWAVE SCENE *Expansion of Radio France* 109

COLUMNS

FORUM *Service Manuals: The latest in banned books!* 24
THE SERVICEMAN *I thought I knew all the tricks* 69
RECORD REVIEWS *Classical, popular, special interest* 120

DEPARTMENTS

EDITORIAL 3 — NEWS HIGHLIGHTS 6 — CIRCUIT AND DESIGN IDEAS 67 — LETTERS TO THE EDITOR 104 — BOOKS AND LITERATURE 106 — NEW PRODUCTS 111 — INFORMATION CENTRE 130 — MARKETPLACE 134 — NOTES AND ERRATA 133.

AC or dc voltage displayed in dBm referenced to 600 ohms, or relative dB.

Measures frequencies from 12Hz to 200kHz, fully auto-ranging, with 1-second response time and 0.01 Hz resolution to 200Hz.

Selectable visual (→+) and audible ()))) indicators for high-speed continuity checking. 50µS response time.

Relative reference (offset) feature works with all functions — including frequency and dB—to indicate ± deviations from stored inputs.

NEW FLUKE HANDHELD DMM COMBINES 0.04% ACCURACY, 10µV RESOLUTION, TRUE RMS AC, DIRECT dB and FREQUENCY

8060A

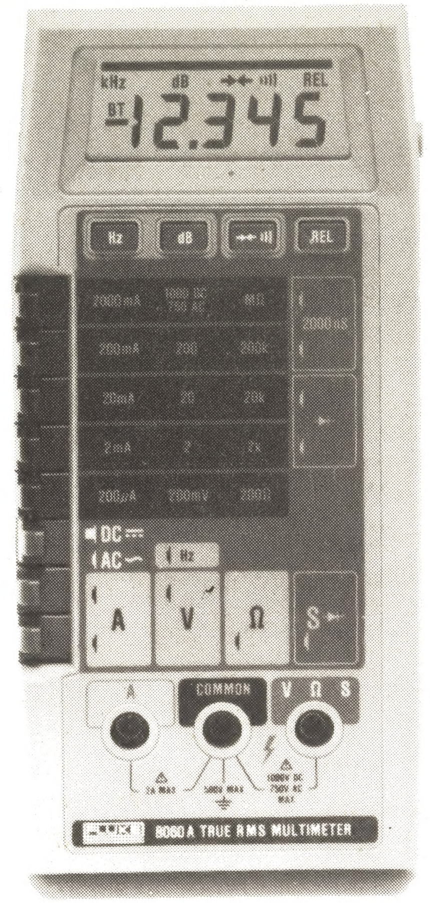
This remarkable state of the art DMM combines the accuracy and resolution of larger, more expensive instruments with the convenience of a hand-held instrument. Flukes own LSI/microcomputer design provides:

- Wideband true RMS AC measurements to 100kHz
- Frequency measurement to 200kHz
- dBm and relative dB
- 10µV sensitivity
- Direct resistance measurement to 300Meg
- Relative reference on any range or function
- Microcomputer-based self diagnostics

8062A

Provides continuity and relative reference functions as 8060A also true rms to 30kHz.

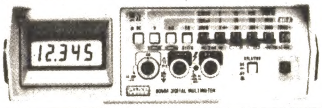
	4½-Digit Resolution	Wideband True RMS AC	Continuity (Audible & Visual)	dBm, Relative dB	Frequency	Relative Reference (Offset)	Autoranging Megohms	Conductance	Constant-Current Diode Test	Self Diagnostics	Basic DC Accuracy	
8060A	●	100 kHz	●	●	200 kHz	●	●	●	●	●	0.04%	**$398**
8062A	●	30 kHz	●			●	●		●	●	0.05%	**$318**



8050A

A bench portable providing 4½ digits with a basic accuracy of 0.03%. True rms measurements to 50kHz, 108dB range and 16 selectable reference impedances from 8 to 1200ohm.

$425



CHECK THE COMPLETE FLUKE 8020B SERIES OF DMMS

8020B

- 0.1% basic accuracy, 3½ digit
- Improved version of the most popular DMM ever made!
- Eight functions including conductance and diode test
- Now with high speed beeper

8021B & 8022B

- 0.25% Accuracy, 3½ digits
- Extensive overload protection
- AC and DC Voltage and Current, Resistance and Diode Test
- High Speed audible continuity beeper (8021B Only)
- 8022B is Fluke's lowest price DMM

8024B

- 11 functions including temperature with K-type thermocouples
- Peak hold on voltage and current ranges
- Logic detection and continuity
- Audible and visible indicators
- 0.1% basic accuracy, 3½ digit

Selection Guide

	DC Voltage	AC Voltage	DC Current	AC Current	Resistance	Diode Test	Conductance	Continuity	Logic Level	Temperature	Peak-Hold	DC Accuracy	
8022B	●	●	●	●	●	●						0.25%	**$162**
8021B	●	●	●	●	●	●		●				0.25%	**$172**
8020B	●	●	●	●	●	●	●	●				0.1%	**$219**
8024B	●	●	●	●	●	●	●	●	●	●	●	0.1%	**$275**

FLUKE®

All prices are plus sales tax if applicable and subject to change without notice.

ELMEASCO

Instruments Pty. Ltd.

P.O. Box 30, Concord
N.S.W. 2137
13-15 McDonald Street,
Mortlake, N.S.W.
Telephone (02) 736 2888
Telex 25887

P.O. Box 107, Mt. Waverley
Victoria 3149
21-23 Anthony Drive,
Mt. Waverley, Victoria
Telephone (03) 233 4044
Telex 36206

Adelaide: (08) 271 1839
Brisbane: (07) 369 8688
Perth: (09) 398 3362

bankcard
welcome here

MAIL COUPON FOR FREE GUIDE

Please send me details of Fluke DMMs
☐ 8060/62 & 8050 ☐ 8020B Series

NAME ....

ADDRESS ....

.... P'CODE ....

TELEPHONE ....

Editorial Viewpoint

60 years young and still going strong

Those who read our regular feature "50 and 25 years ago" will be aware that this month we celebrate the 60th anniversary of the founding of "Wireless Weekly", the forerunner of this publication. In fact, after 60 years of continuous publication, albeit under different names, "Electronics Australia" is one of the longest running technical publications in the world!

Apart from our longevity, "Electronics Australia" is also unusual in that we have a full-time staff producing a constant stream of technical projects and circuits. So much so that we have at times been referred to as the "circuit farm". We certainly do not mind this nickname as it indicates the emphasis we place on do-it-yourself projects. It has always been this way.

Fifty years ago, "Wireless Weekly" was actively promoting do-it-yourself five valve superhets. Twenty five years ago, "Radio, Television and Hobbies" was describing the construction of a 17-inch TV receiver. And this month, we are presenting full details of a Car Computer developed by our technical staff.

Fifteen years ago, with the advent of the integrated circuit, some readers saw a gloomy future for the electronics hobbyist but it has not proved to be so. While mass-produced consumer electronics has made some constructional projects not worthwhile, such as cassette decks and TV receivers, advancing technology has made others more feasible. An example of this is our Car Computer.

In fact, as time goes on, the scope for do-it-yourself electronics seems to be expanding rather than contracting. More people than ever before are building and enjoying kits and using "black box" integrated circuits to put together their own circuit creations. As a result, the kit and electronic parts business is booming. One has only to look through the pages of this magazine to see the extraordinary competition between advertisers in this line of business.

Naturally, we welcome this. Not only does it mean continuing support for our magazine from readers and advertisers alike, but also that there is a growing outlet for individual creativity in the future. This, surely, is one of the bright aspects of advancing technology.

In coming years we will continue to keep you abreast of the latest technology and, at the same time, give you an opportunity to participate by doing-it-yourself.

Leo Simpson

EDITOR-IN-CHIEF
Neville Williams
S.M.I.R.E.E. (Aust.) (VK2XV)

EDITOR
Leo Simpson
B. Bus. (NSWIT)

ASSISTANT EDITOR
Greg Swain, B.Sc. (Hons. Sydney)

TECHNICAL PROJECTS
John Clarke, B.E. (Elect. NSWIT)
Peter Vernon, B.A. L.L.B. (NSW)
Jeff Skeen
Colin Dawson

GRAPHICS
Robert Flynn

PRODUCTION
Danny Hooper

SECRETARIAL
Pam Hilliar

ADVERTISING MANAGER
Selwyn Sayers

CIRCULATION MANAGER
Alan Parker

Editorial and Advertising Office
57 Regent St, Chippendale 2008.
Phone (02) 699 3622 Telex 25027.
Postal Address: PO Box 163, Chippendale, 2008.
Advertising Sales Manager: Sel Sayers.

Melbourne — 392 Little Collins St, Melbourne 3000. Phone (03) 602 3033.
Representative: Mark Christian.

Adelaide — Charles F. Brown & Associates Ltd, 278 Halifax St, Adelaide, 5000.
Representative: Sandy Shaw (08) 267 4433.

Perth — 454 Murray Street, Perth 6000.
Representative: Ashley Croft (09) 321 8217.

Circulation Office
21 Morley Ave, Rosebery, Sydney 2018.
Phone (02) 663 3911.

Subscriptions
Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001.
Enquiries: Phone (02) 20944, ext 2589.

Distribution
Distributed in NSW by Magazine Promotions, 57 Regent St, Chippendale; in Victoria by Magazine Promotions, 392 Little Collins Street, Melbourne; in South Australia by Magazine Promotions, 101-105 Waymouth St, Adelaide; in Western Australia by Magazine Promotions, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 93 Macquarie St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

Registered by Australia Post — publication No. NBP0240.

Copyright. All rights reserved.

Devices or arrangements shown in this magazine may embody patents. Information is furnished without responsibility for its ultimate use, or for failure of equipment to operate as expected, or for any damage, loss or injury which may be sustained. Material intended for publication is submitted at the sender's risk and, while care will be taken, responsibility for any possible loss will not be accepted by "Electronics Australia".

Printed by Magazine Printers Pty Ltd, of Regent Street, Chippendale and Masterprint Pty Ltd of Dubbo NSW for Magazine Promotions, of Regent St, Chippendale.

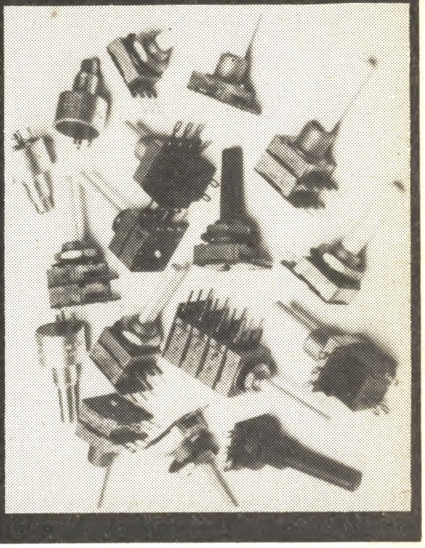
ISSN 0313-0150

* Recommended and maximum price only.

PRICE MADNESS -

E HAVE RECENTLY PURCHASED OVER $70,000.00 WORTH OF

WILL POTS EVER BE THIS CHEAP AGAIN????



PACK 1

This pack contains over 50 assorted potentiometers (see note below). We have deliberately kept the weight of this pack down to 500 grams so that postage is not too bad.

P & P $1.20

$9.95

THAT'S JUST UNDER 20 CENTS EACH!!

PACK 2

This pack contains over 120 assorted potentiometers. Whilst weighing in at over a kilo it's fantastic value despite the extra postage.

P & P $4.00

(Note the higher than normal postage)

$19.50

THAT'S JUST OVER 16 CENTS EACH!!

PACK 3

This is the big daddy of them all.

Over 250 pots in all!! Enough to last most people a lifetime. The advantage of this pack is that you usually get a fair quantity of each value which can be handy.

We send this one out by road because postage would kill us!!

$6.00 Freight

$34.50

THAT'S JUST UNDER 14 CENTS EACH!!

NOTE: Each pack contains the same style of pot which includes:- single gang and dual gang. Switched and unswitched in log and linear. All pots have plain shafts, most with a flat and have either PCB type terminals or solder eyelet terminals. Up until June this year they sold for 50 cents each (single gang) in 100+ quantities. THEY ARE BRAND NEW STOCK

Trimpot pack

Firstly, these are not flimsy Asian made product. They are pro-grade types. The pack contains an assortment of PCB mount (horizontal) and panel mount and SOME multiturn styles.

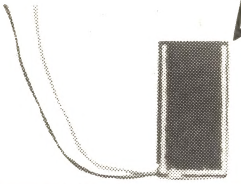
Each pack contains over 200 pots!!

$9.95 $9.95 $9.95 $9.95 $9.95 $9.
$9.95 ONLY ONLY ONLY $9.9
$9.95 $9.95 $9.95 $9.95 $9.95 $9.

Silicon Photocells

We have not got the time to measure them so we've cut the cost! They all work though. Quantities strictly limited so hurry! At this price you can gang them up for high current!

45mm diameter	$1.50
30mm diameter	95 cents
25x12 (rect)	50 cents



FROM 50 CENTS

JAYCAR EXCLUSIVE

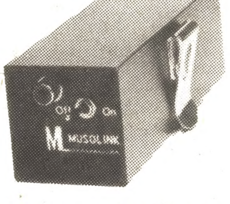
Wireless Guitar Link

MASSIVE PRICE BREAKTHROUGH!

– NOT A TOY –

– NOT A KIT –

Free yourself from the lead to the amp. This unit gives a ROCK SOLID SIGNAL over a 50 metre (YES!) range. Specially designed to take electric guitar signal levels. This small 9V battery powered unit clips to the strap. You won't notice it when playing! Transmits to any FM tuner in the little-used 88-100MHz band. You can even practice at home on your Hi Fi. This is a professional unit at a budget price. Bring your guitar in for a demo or send SAE for more information. This unit is 100's of dollars cheaper than inferior units.



STAGGERING VALUE AT

$149.50 (UNIT ONLY)

AUTORANGING DIGITAL MULTIMETER SENSATIONAL NEW PRICE!!

GRAB ONE NOW WHILE STOCKS LAST

The response to our special price for the ME-532 was fantastic. We still have a few left – and we only mean a few.

So if you want the best value **autoranging** digital multimeter in Australia **—ACT NOW.**

SOAR BRAND

ME532 with low ohms buzzer ONLY $49.50
SAVE OVER $10.00

$49.50

PLUG-IN
1% CURRENT
SHUNT (TO 30 AMPS)
TO SUIT BOTH
METERS ONLY
$8.50

SHUNT ALSO SUITS DICK'S METER

FEATURES: – 3½ DIGITS LCD
– AUTO RANGING
– AUTO POLARITY
– SAMPLING RATE: 2/sec
– 0-1KV DC +/-1.35% worst case
– 0-600VAC +/-2.3% worst case
– 0-2Mohm
– 0-200mA
– POWER CONSUMPTION 5mW
ME532 ONLY – RANGE CHANGE
INDICATION BY ELECTRONIC BEEPER
– SHORT CIRCUIT GO/NO GO BEEPER

JAYCAR DEALER: G&J Electrics Forresters Beach NSW 2260 Phone (043) 845787

WHEN WILL IT END?

MANUFACTURERS SURPLUS STOCK. THEIR LOSS YOUR GAIN!

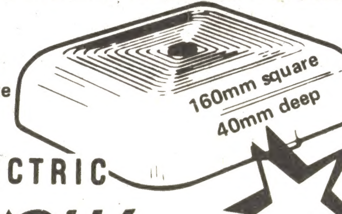
SMOKE DETECTOR & G.E. BURGLAR ALARMS BACK! WE RAN OUT FOR A WHILE BUT FOUND MORE!!

Smoke Detector

CONSUMER FLOP — CONSUMER FLOP
CLUB, HOTEL, HOSTEL & MOTEL MANAGERS
PLEASE NOTE

One of the greatest consumer flops of the last decade was the Ionization Chamber Smoke Detector. Even though it is a brilliant product (reliable compact, easy installation, fail-safe etc) it just did not sell. Human nature being what it is finds safety-oriented products just not worth the investment. We all know that accidents and fires never happen to US!!
As smoke is the greatest killer in a fire, the market research gurus thought that such a product would have wide appeal.
When they were $49.50 no-one wanted them. The price fell to a very reasonable $29.50 and still they stayed on the suppliers shelves.
We have now been in instructed to clear them for less than ½ of $29.50

- Contains Americium 241 Ionization Chamber
- 9V Mallory Duracell included
- Contains very loud solid state buzzer
- 12 month factory warranty



GENERAL ELECTRIC

Grab One NOW **$14.50**

✱ FAMOUS ✱ GENERAL ELECTRIC

BURGLAR ALARM SLASHED!!!
HUGE SCOOP PURCHASE — ONCE SOLD FOR OVER $100

Slashed to **$29.50**

Amazingly low price for a full feature ultrasonic proximity/burglar alarm. + Completely self contained + 12 month manufacturer guarantee + Instant or delayed alarm + Handsome imitation woodgrain + Cabinet measures 180Wx85Hx100D + Programmable multi-code disable switch + Single 9V Alkaline battery* lasts one year + Unit beeps when battery gets low + Contains receiver element designed for greater sensitivity without false triggering + Uses State-of-the-art LSI circuitry + Worth the money in parts alone + Comprehensive 24 page manual included + Comes complete with 4 window deterrent stickers + Absolutely no installation needed. * Battery extra

SAVE A FORTUNE — COMPARES WITH UNITS OVER $100
Below cost distress stock — Factory orders to sell.

HUNDREDS OF EACH SOLD FROM OUR JUNE AD — NOW BACK IN STOCK

Logic Probes~a few left

We had more of the LP-2 & PLS-1 units to start with. They are very fast sellers though and will be gone by the end of August for sure. They are genuine factory distress stock items and real bargains!!

LP-2 Logic Probe 1.5MHz (tested to 4MHz)
DTL/TTL/CMOS with instruction manual **WERE $49.50**
NOW $19.50 SAVE $30.00!!!

PLS-1 Logic Pulser — As handy as a probe at least! Single or train of pulses. 2uS nominal limit. High input impedance. Compatible with all logic families. **A MUST FOR THE TROUBLE SHOOTER!**
WORTH OVER $100
SACRIFICED AT ONLY $39.50
Both units are made in the USA

$39.50

$19.50

Proximity Switch ✱ ✱

12V powered unit. When metal object passes near target face the output swings low. This is sufficient to latch a relay etc.
Ideal for burglar alarms on Roller Shutter Doors etc or any application where moving objects need to be counted etc.
Manufacturers Distress Stock — You Gain.

only $29.50 WAS OVER $100!!

motor service indicator ★★★

A GREAT IDEA THAT DID NOT CLICK

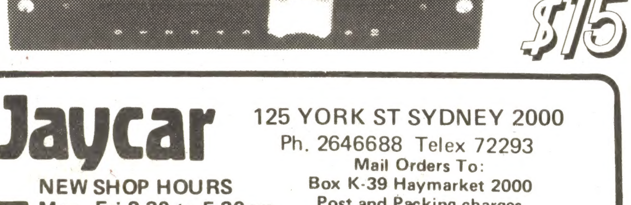
This interesting device was designed for truck or car fleet owners etc. It also can be used for motor boats. Basically the unit is activated when the ignition is turned on. A programmable long-sequence timer (Plessey E-Cell) measures the time that the motor (i.e. car, truck or boat) runs. After an appropriate time the unit changes its dash-mounted display from Green to Red to indicate that a service (e.g. grease and oil change) is required. This unit was going to sell for around $50 to fleet quantity people. Somehow it just did not click. They contain lots of valuable goodies (e.g. Plessey E-Cell, LED bezels, miniature switches connectors etc) and we have the first (and last) production run of them. You can have one for a mere five dollars. The parts are worth far more.

90% DISCOUNTED
$5
WERE $50

quality FADER control

The Ultimate Fader!!

High stability Plastic film resistive element. 10k ohms linear.
Precision guide rod inside housing ensures uniform contact wipe pressure. Designed for tens — even hundreds — of thousands of noise-free operations. Complete with heavy gauge metal escutcheon panel with calibration markings and mounting holes.
Ideal for video mixers or extremely high quality audio. English made. Sold for over $70 each.
Limited quantities.
Approx. 175x45x50 mm



$15

Jaycar

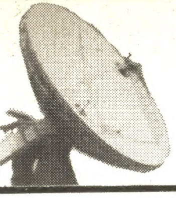
125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293

NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Orders To:
Box K-39 Haymarket 2000
Post and Packing charges

$5-$9.99 ($1.20)	$10-$24.99 ($2.40)
$25-$49.99 ($3.50)	$50-$99.99 ($4.60)
$100 up ($6.20)	

NEW JAYCAR STORE OPENING NEXT MONTH AT CARLINGFORD, RIGHT AT CARLINGFORD COURT, NEXT DOOR TO KENTUCKY FRIED CHICKEN



News Highlights

Thor — GEC's new arc welding robot

EA staff were present at a recent press demonstration of a new computerised arc welding robot from Japan. The robot, aptly named Thor, is the subject of a marketing agreement between the specialist welding equipment manufactured Osaka Transformer Company and GEC Australia Ltd.

Thor is the first robot of its type in the world and, since it was designed by a welding equipment manufacturer, its computer also controls all the welding parameters such as volts, amps, weld speed and gas feed. While initially designed to work with Osaka welding equipment, the Thor will work equally well with thyristor-controlled welding gear already being marketed in Australia.

In appearance, Thor is not particularly imposing although it is painted bright orange and sits on a large pedestal about 43cm in diameter. It has a single articulated arm which is fitted with a welding torch. The torch can move anythwere within an arc of about 1.5 metres radius and 300 degrees of rotation and between heights of about 1.5 metres and 0.5.

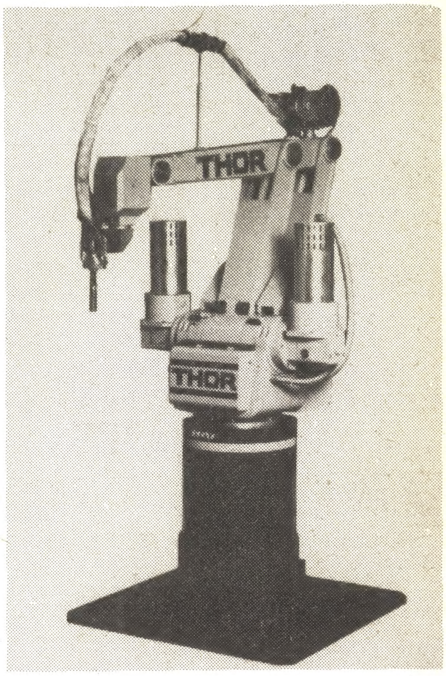
What is imposing is the machine's marked agility in positioning the torch anywhere within the working space and its ability to hold the torch at any attitude with regard to the work surface, regardless of the shape of the object to be welded. The welding head has five degrees of freedom plus what Osaka term the gyro-axis.

We were intrigued with the way the welding head could be manouvred around at virtually any angle or attitude while the tip of the torch stayed at a fixed point in space.

Thor can work on as many as six welding stations sequentially and can hold up to 100 welding programs.

Special welding operations such as weaving, cratering and tapering off can easily be punched into the program without any need for a "teaching" procedure. Position repeatability is good to within ±0.2mm.

Programming Thor is accomplished by leading the robot through each step of the job, with the aid of a portable keyboard. Even here, Thor shines because it has automatic linear and circular interpolation: merely being shown two points on the job allows welding along straight lines while three points is sufficient to allow welding on a circular curve, with the torch being held at the correct attitude all the time.



Thor is envisaged as being suitable for applications on high volume production lines or in small-scale production requiring a large variety of operations.

AM STEREO: FCC'S DECISION IS "NO DECISION"

Over the past few years, AM radio broadcast stations have been steadily losing listeners to FM stations. Stereo FM is an obvious choice over mono AM for the listener concerned with sound quality.

AM broadcasters in the United States are looking for a way to reverse the trend. Many see stereo AM as the answer.

In some circumstances AM already has advantages over FM radio. Longer range for amplitude modulated signals means that one AM station can serve a bigger area — and hence more listeners. Problems with multiple signal paths can also degrade FM performance.

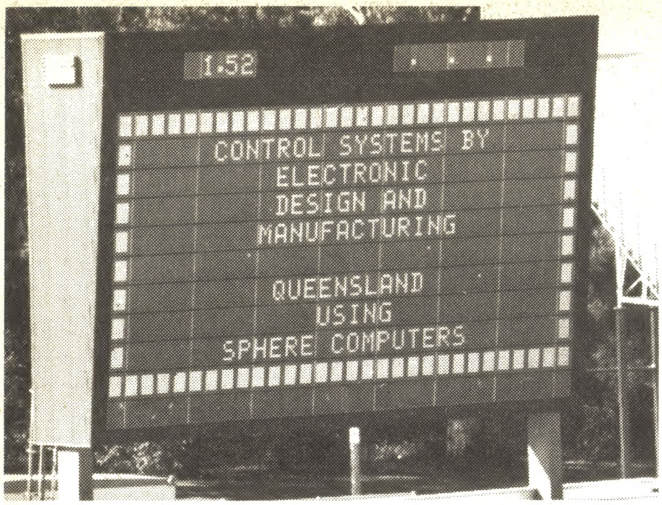
One problem hindering stereo AM as a commercial possibility is the limited frequency response possible in the AM band. Another is the competition in the United States between proposed AM stereo techniques.

Of five systems proposed, the Federal Communications Commission (FCC) originally approved the Magnavox system, and some transmitters were established and receivers sold, for this system. Then the FCC decision was challenged in the courts, and the challenge upheld.

In March this year the FCC decided after five years of deliberation not to choose any one system as a standard. Instead they ruled that broadcasters can use any stereo AM system as long as it doesn't interfere with present mono AM systems.

Because of the intense competition between broadcast equipment manufacturers, many US observers are predicting that stereo AM will be introduced by the end of this year. Listeners, however, may face the daunting prospect of receivers equipped with a five-way selector switch which must be set according to the transmission method being used.

Another possibility is that the Japanese will solve the dilemma by manufacturing and exporting a receiver to suit one system — probably Magnavox — and thus provide the lead necessary to break the deadlock.



Commonwealth Games scoreboards

Pictured at left is the giant scoreboard of the QEII Stadium at Nathan, Brisbane, specially commissioned for the Commonwealth Games. To give an idea of its size, each letter of the display is 36cm high, and there are 11 lines, each of 30 characters. A clock and elapsed time display is included on the scoreboard.

The scoreboard uses 5 x 7 dot matrix displays by Claude Neon, assembled with control equipment by Electronic Design and Manufacturing Queensland (EDMQ). The scoreboard, and a smaller one at the Velodrome, Chandler, are controlled by computers supplied and installed by Paris Radio Electronics of Sydney.

The control console includes a message switching centre and a printer for a permanent record of games statistics.

Haven't we met somewhere before?

Scientists at Brunel University, near London, have developed a computerised pattern recognition system that can be trained to identify a human face within three seconds.

The seeing machine, known as "Wisard", was originally designed for use by banks for identifying handwritten information on documents such as cheques, but as its inventor, Professor Igor Aleksander points out, it can be taught to identify virtually anything.

With its ability to recognise faces, one application of Wisard would be security work. Another is the improvement of computer terminals capable of accepting hand written information. Because Wisard is several times faster than any similar machine, it would be extremely attractive as a reading machine for the blind.

Electronic control for Ford engines

Among US automobile manufacturers Ford Motor Co is currently lagging in development of electronic engine controls, but the company has big plans.

Recently Ford introduced a two-chip set, custom made by Intel Corporation, for engine control applications. According to Robert S. Oswald, an engineer at Ford's electrical and electronics division, the 16-bit microcomputer system has enough speed, input/output and memory capacity to handle Ford's needs at least until 1988.

Other projects at Ford include a multifunction cathode ray tube information centre for cars of the next decade. The 12.5cm visual display unit includes a navigation system which uses satellite data to pin-point the car's location on a map display, a radio control panel, and an automatic temperature control panel.

Milton Keynes — electronics showpiece or technology gone mad?

A town called Milton Keynes, being built north of London, UK, may become an "electronics showpiece" for the rest of Europe.

Among other things the new city will be the site of a prototype "electronic house", but plans are also underway to link the entire city into an extensive communications network. As a spokesman for the developers of the new town put it, "We aim to make Milton Keynes the foremost city in Europe for the practical application of information technology in the workplace, the home and the community".

The electronic house due to be completed later this year will contain "every available type of labour-saving microelectronic device". Aids will include video links between the house and the owner's workplace, access to libraries, and electronic banking and shopping through a video display terminal.

Computers will have full control over heating and lighting. A household management system will store household accounts, recipes, shopping lists, freezer inventories, family messages, and other records. The occupant can program doors and curtains to close automatically at a set time, or order the bath to be filled to a selected depth and pre-programmed temperature!

Twenty thousand more ordinary houses have already been built, each linked through a co-axial cable TV network, and a trial of fibre-optic television relay cables is under way.

Trials are also being carried out to see if household gas, electricity, and water meters can be read remotely. Meters are modified to transmit signals to microcomputers in selected houses. The information is then conveyed over the power cables to a local transformer substation, and then by telephone cable to the supply authority.

The new town will also have its own viewdata system that can be linked to existing national and international teletext databanks. Local business will be able to store and retrieve information from computer banks, send messages, and collect information from a variety of sources. TV screens at strategic public sites are also planned to give information on bus and train timetables as well as guidance on shopping and entertainment.

English-Japanese translation system

Hitachi Ltd has announced the development of a computer translation system capable of translating English text into Japanese. According to reports, the system can translate first-year high school textbooks, and is a big step towards the practical use of language translation machines in the future.

Work on computer-based translation systems is also underway in many other countries. In Canada, for example, a system has been developed which translates the weather forecast and related data from English into French. However, translating from English to Japanese is much more difficult, according to Hitachi, because of the structure of the Japanese language.

NEWS HIGHLIGHTS

STAND CLEAR — ROBOT AT WORK!

An industrial robot started work at the University of Sydney recently — as a teaching aid.

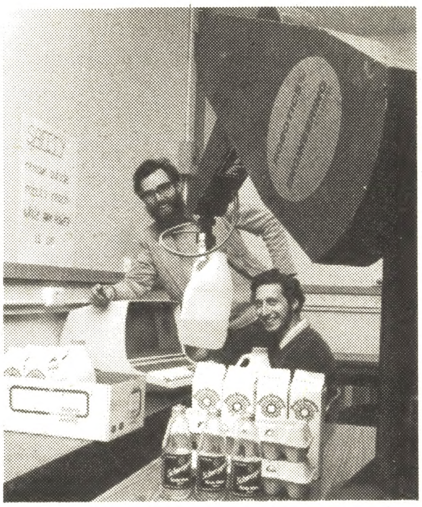
The robot will be in use initially in teaching a one term optional course to a group of fourth year honours students in computer science.

Installed at the University's Basser Department of Computer Science, the PUMA 500 robot has so far done nothing more complex than pack a box of groceries, but staff have already emphasised the need for safety in its operation.

Speaking at the robotics section of the ANZAAS conference earlier this year, Dr Don Herbison-Evans said that during its installation trials the robot made an unexpected swing because of a mistake in a control program.

"Fortunately no-one was standing within its reach when this occurred", the doctor said. "Industrial robots like this are big, heavy, and fast-moving. They are capable of causing serious injury and we'll be warning our students of the need to stay outside the safety fence when the power is on."

One of the lecturers in the robotics course is Dr Michael Kassler. He says that although robotics is still in its early days, robots have an annual sales growth rate of 35% in the US and are starting to "take off" in Australia.


Dr Don Herbison-Evans (left) and Dr Les Goldschlager watch the robot pack groceries.

"The Myers Committee identified robot technology as one of the six most important technologies for Australia in the 1980s" Dr Kassler said. "There will undoubtedly be a strong demand for graduates with robot experience".

One of the projects the robotics section is currently working on is an automated packing program, capable of packing odd-shaped and fragile goods. The ultimate aim is a program with potential for use in automated supermarkets and warehouses.

Robots — a timely warning from Britain

Aberrant behaviour of faulty robots is a new hazard for the declining number of people on the factory floor, according to a survey by the British Machine Tool Trades Association.

The Association has recently published its report, entitled "Safeguarding Against Industrial Robots". Hazards it identifies include jammed servo valves, the robot which accidentally cuts its own control cable, failure of exposed hydraulic lines, and most important, a fault in data transmission that causes the robot to move in an unexpected way.

Advances in technology may lead to other hazards which are not covered by existing industrial standards.

The British survey draws on a Japanese report of 1977. Japanese researchers found that only about 10% of robotic accidents occurred in normal operation. The greatest risk occurred during programming, teaching and maintenance.

Dick Smith solo around the world by helicopter

On August 5th, 1982 Dick Smith will begin his attempt to make the first solo helicopter around-the-world flight. The first leg (from the 5th to 15th August) will take him from Forth Worth USA to England via Iceland and Greenland. The second leg from London to Sydney, will be in September and October, while the third leg has yet to be announced. All flying will be in daylight and Dick will be using the amateur bands for communication.

Dick is hoping for the call sign "VK2-DIK Helicopter Mobile" and is frantically studying Morse at the time of writing, in preparation for the exam. Dick will be using a Collins HF220 transceiver on upper sideband only, on the following frequencies: 3.75MHz, 7.06MHZ, 14.25 and 14.14MHz and 21.285 and 21.265MHz.

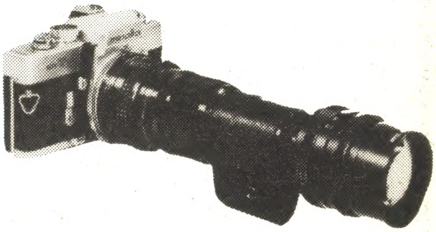
3D television from Laser disc

Philips have announced details of an experimental three dimensional television system user Laservision discs.

The equipment used is not cheap — it includes two Laservision discs and players and a pair of specially adapted television projectors — but reports are that it produces the best 3D pictures seen so far.

First demonstrated at a trade show in London, the video disc system projects left and right images synchronised by a microcomputer. Viewers wear polarised lenses and see a separate image for each eye. (See article in our July issue).

Want to take photos in the dark?



Nature photographers and others wishing to take night time photographs without disturbing their subjects now have available a new optical attachment that allows a camera to virtually "see in the dark".

The Litton SLR Camera Relay Lens allows night photos to be taken in black and white, without artificial illumination. It can be fitted to almost any 35mm SLR camera with a single adapter ring.

An image intensifier tube in the Relay Lens amplifies moonlight and starlight to give the camera a night time capability. The amplified image is displayed on an in-built viewing screen, and the image intensifier is powered by an internal mercury cell which supplies power for up to 90 hours of operation.

The image intensifier is not for the casual hobbyist, however. It costs around $4500 without accessory lenses.

For more information contact Litton Precision Products International, 3 Uther Street, Surry Hills, NSW, 2010.

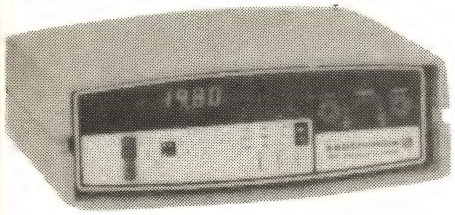
Fingerprints on computer

Printrak, a computerised finger print matching system developed in the USA by Rockwell, has been purchased by the De La Rue Company of London.

The system takes finger prints, digitises them and then looks for a match among similarly digitised prints held on an electronic file. It is already in use in seven installations in the United States.

sabtronics PRECISION INSTRUMENTS
NEW LOW PRICES FROM CHRISTIE RAND

DIGITAL MULTIMETER

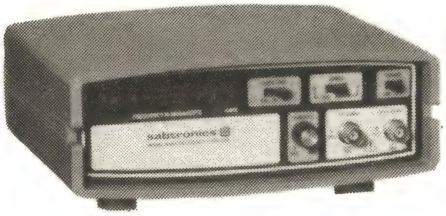


- BASIC ACCURACY 0.1%DC, 0.5% AC
- DC & AC VOLTS 100uV to 1000V
- AC VOLTS TO 40KHz
- DC & A C AMPS 0.1uA to 10A
- RESISTANCE 100n to 20M
- OVERLOAD PROTECTION TO 1.2 KV DC OR PEAK AC
- DIODE TEST

BENCH DMM	PRICE	TAX
* 2010 LED kit	$110	$13.28
* 2010 LED asbl	$120	$13.28
* 2015 LCD asbl	$140	$15.32

HAND HELD DMM 2A MAX		
* 2035 LCD kit	$110	$13.28
* 2035 LCD asbl	$120	$13.28
* 2037 WITH TEMP PROBE −50+150		
* 2037 LCD kit	$135	$15.32
* 2037 LCD asbl	$145	$15.32

FREQUENCY COUNTER



- GUARANTEED 10Hz to 600MHZ
- TYPICAL 5Hz to 750Hz
- SENSITIVITY 10mV RMS to 100MHz & 70mV to 600MHz
- GATE TIME 0.1, 1,10 SEC
- AGEING RATE ± 5PPM/YEAR
- TEMP STABILITY .1PPM/C°
- INPUT PROT 90V RMS TO 10KHz

8610A 8 DIGIT	PRICE	TAX
* 8610A LED kit	$159	$18.38
* 8610A LED asbl	$174	$18.38
8610B 9 DIGIT		
* 8610B LED asbl	$179	$19.95
8000B 9 DIGIT 1 GHz		
* 8000B LED asbl	$259	$21.00

Batteries Not Supplied

Postage & packing $3.00

FUNCTION GENERATOR

- 1Hz TO 200kHz
- SINE SQUARE & TRIANGLE
- DC OFFSET
- SINE WAVE ACCURACY 1%
- OUTPUTS
  HIGH 10 VPP 600
  LOW −40 dB
  TTL
- SWEET INPUT 100:1 RANGE

* 5020 kit	$151	$13.92TX
* 5020 asbl	$161	$13.92TX

Distributor Enquiries Welcome

bankcard
welcome here

CHRISTIE RAND PTY LTD
PO BOX 48 EPPING,
NSW, 2121
PHONE (02) 868 1209

BUREAU OF
METEOROLOGY
DEPARTMENT OF
SCIENCE AND TECHNOLOGY

Are you interested in a career in ELECTRONICS, working with modern RADAR and TELEMETRY equipment? If so, then the Bureau of Meterorology is interested in You!

RADIO TRAINEES

The Bureau of Meteorology is currently seeking a number of young people, interested in electronics, to train for the position of Radio Technical Officer.

Applicants must have passes in English, Physics and Mathematics A and B at Victorian Year 11 standard or equivalent; or eligibility to enrol in the Certificate of Technology (Electronics) course. They will undertake a four year training program which involves equal time at the Royal Melbourne Institute of Technology and the Bureau's Central Training School in Melbourne.

Salary during training will be payable within the range of $7536-$14,140 depending on age. Successful applicants must be prepared to serve at any meteorological office in Australia or its territories. Both men and women may apply.

Application forms and additional information can be obtained by contacting:

Director of Meteorology,
PO Box 1289K,
MELBOURNE, VIC, 3001.

Telephone (03) 669 4338 or 669 4337
or by contacting the Bureau of Meteorology in your state.

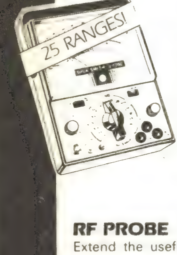
APPLICATIONS CLOSE September 2, 1982.

CORRECTION ...
In the Dick Smith Kit Catalogue (inserted in EA last month and available from all Dick Smith stores) two kits were shown with their magazine references transposed. The Earth Leakage Detector Kit (Cat K-3315 @ $45.00) was published in ETI while the Infra Red Light Beam Relay Kit (Cat K-3380 @ $59.00) appeared in EA magazine. Also on the Playmaster Speaker Kits page, readers should note that the 200mm system shown is not the new style, but the original. The 250 and 300mm systems are the new style as photographed.

Measure It ...

20k/v - 20 Ranges!!
It may be a budget multimeter, but this one has top performance for the price: an amazing 20,000 ohms per volt & it's under $20! Huge easy-to-read scales with 20 ranges. Comes complete with batteries, test leads and instructions. Cat Q-1020.

ONLY $19.95



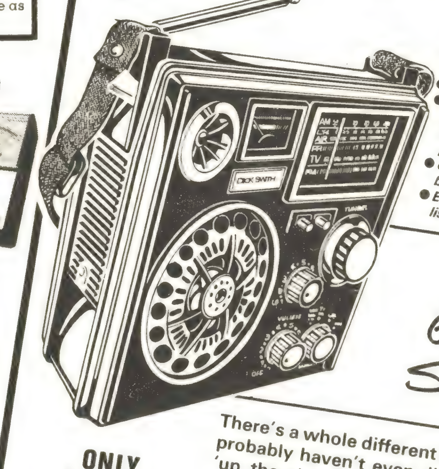
10 MEG FET INPUT
For the professional who wants the lowest circuit loading ... you want the highest input impedance. The FET input multimeter gives you a huge 10M input impedance on DC voltage, and a highly respectable 1M on AC voltage. Batteries, test leads & instructions supplied.
Cat Q-1200

ONLY $72.00

RF PROBE
Extend the useful range of your multimeter way up into the RF range with this great probe. Frequency response is 150kHz to 30MHz (ref. 500kHz). Comes equipped with banana plug for direct multimeter connection. Cat Q-1138

ONLY $17.95

WHY PAY MORE?
Look at what you get with the Dick Smith Communicator VHF/AM Radio



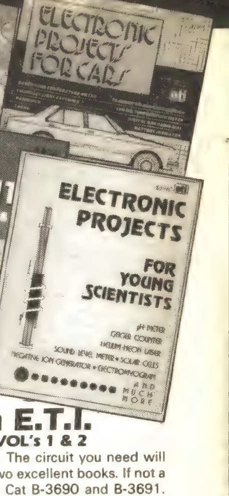
- 6 bands with handsome 'military look
- 240V AC & 6V DC (battery) op.
- Complete with multi-section adjustable telescopic antenna for vertical/horizontal polarization
- Unique tuner meter, doubles as battery strength meter.
- Earphone jack for private listening (earphone supplied)

OVER 6,000 SOLD!

ONLY $65^00
INCLUDES FREE VHF LISTENING GUIDE!

There's a whole different world of radio you probably haven't even discovered yet! It's 'up there' on VHF! This superb portable VHF Communicator Radio will introduce you to the world of VHF — without missing out on the radio stations you also want to listen to. Its six bands cover the AM & FM broadcast stations, through the full 40 channel CB band, up to the VHF bands from 107 to 147 MHz.

These bands include the entire aircraft bands plus the 2 metre amateur band, police, fire, ambulance frequencies, two way car radio, taxis etc.
Cat D-2833


ELECTRONIC GAMES
ELECTRONIC PROJECTS FOR CARS
eti
CIRCUIT techniques
ELECTRONIC PROJECTS FOR YOUNG SCIENTISTS
pH METER
GEIGER COUNTER
HELIUM-NEON LASER
SOUND LEVEL METER • SOLAR CELLS
NEGATIVE ION GENERATOR • ELECTROMYOGRAPH
AND MUCH MORE

NEW TITLES from E.T.I.

CIRCUIT TECHNIQUES VOL's 1 & 2
Save time, effort and money! The circuit you need will probably be in one of these two excellent books. If not a suitable replacement will be. Cat B-3690 and B-3691.

ONLY $4.75 ea

ELECTRONIC PROJECTS FOR CARS
Over 25 projects for the car enthusiast to build. A must for any constructor who take his/her car seriously. Cat B-3680

ONLY $3.95

HOW TO BUILD ELECTRONIC GAMES
Build your own arcade-type games! They look just like the professional ones. Hours of fun! Cat B-3682

ONLY $3.95

ELECT. PROJECTS FOR YOUNG SCIENTISTS
Over 15 specialized projects for the specialized hobbyist, including a geiger counter, sound level meter and more.
Cat B-3681

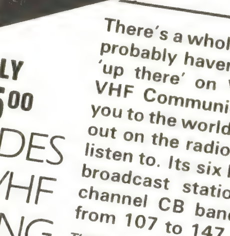
ONLY $3.95

OVER 2,000 SOLD!

HOBBYIST CRO WITH PRO SPECS

This oscilloscope is ideal for the laboratory, classroom, field service, bench service in assembly centres and, of course in hobby applications. Solid state electronics ensures extremely low drift and fast warm up. Features: ● Retrace blanking ● Fibreglass PCB ● Lower threshold triggering ● Sharper focus ● AND A FREQUENCY RESPONSE TO BEYOND 6.5MHz. Cat Q-1280

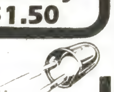
SPECIFICATIONS
Usable bandwidth: DC to 6.5MHz plus.
Vertical deflection sensitivity: 10mV per div.
Horizontal deflec. sensitivity 500mV per div.
Time base sweep freq: 10Hz to 100kHz in 4 ranges
Synchronisation: Internal & External.



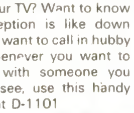
SAVE $20!

ONLY $179.00
WAS ~~$199.00~~

HANDY BNC ADAPTOR
Adapt your input terminals on the Dick Smith Laboratory Oscilloscope from 'banana' socket to BNC type.
Cat Q-1281 ... **ONLY $9.90**



BARGAIN PROBE SET
Get features of a probe set you would pay $$$$ more for with this versatile probe set. Will suit virtually any CRO.
Cat Q-1245.... **ONLY $32.50**



LAST CHANCE! MICROACE KIT
Build your own computer for less than $100 with this superb kit but you better hurry!
Cat K-6500

VERY LIMITED STOCKS!
NOT IN ALL STORES

$99.50
WAS ~~$199~~
SAVE $100!

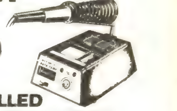
TWO FANTASTIC SOLDERING BARGAINS!

240V 25W IRON
Plug into any power point and get 25w of heat very quickly.
Cat T-1300

ONLY $9.75

OVER 10,000 SOLD!

WOW!
ONLY $59.50



TEMP CONTROLLED SOLDERING STATION
A professional soldering station at a hobbyists price! Fully approved by the Energy Authority, comes complete with iron, holder and cleaning sponge. Cat T-2000

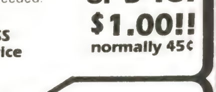
SOLDER
Top quality corrosion free
1.25mm (18g) hobby pack ....
Cat N-1638 .... **$1.20**
1.25mm (18g) 200 grams ....
Cat N-1619 .... **$4.95**
0.71mm (22g) hobby pack ...
Cat N-1636 .... **$1.20**
0.71mm (22g) 200 grams ....
Cat N-1623 .... **$4.95**

DICK-WICK
Known to one and all this is a specially treated copper braid that is used to remove solder from the PC board by capillary action.
Fast, clean and very efficient.

Cat N-1682 ... 1-9 ... **$2 ea**
10 or more .... **$1.70 ea**

AMAZING SCOOP PURCHASE

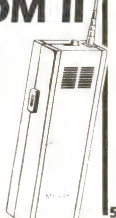
9 DIGIT RED LED DISPLAY
Ideal for the finishing touch to that special project you've been working on.
Cat Z-4155



and only
$1.50

Hobbyist uses for our new POCKET COM II

Not only for kids, this superb, compact walkie-talkie can be used in many other ways. Putting up an antenna for your TV? Want to know what the reception is like down below? Mums, want to call in hubby for lunch? Whenever you want to communicate with someone you can't hear or see, use this handy transceiver. Cat D-1101



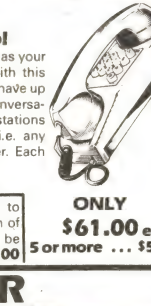
ONLY $9.95

DON'T SHOUT (Except at the pub!)

6 station intercom
Fast, efficient means of communication within your home, office, factory, even small hospitals, motels etc can find them useful.
Up to 3 simultaneous conversations are possible with this system. Each unit can call any other connected up. Superb styling. Each unit sold separately. Cat F-1310

ONLY
$46.50 ea
5 or more ... $39.00

AND
12 stations too!
Expand your intercoms as your requirements grow. With this superb system you can have up to 6 simultaneous conversations, with all the stations being 'master' type - i.e. any station can call another. Each unit sold separately.
Cat F-1320

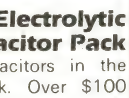


ONLY
$61.00 ea
5 or more ... $55.00

INTERCOM TERMINAL BOARD Enables you to wire up your 6 or 12 station system with a minimum of fuss. Specially imported for the above systems, it can be mounted anywhere convenient. Cat F-1321 ... **$61.00**

SAVE! SAVE!

AMAZING FLASHING LED
Inside this standard size (5mm) red LED is a tiny microcircuit which causes it to flash. Think of the dozens of applications where a flashing warning is needed!
Cat Z-4000



25¢ or 5 for $1.00!!
normally 45¢

and now LESS than HALF price

SAVE $$$
OVER $100 WORTH!

Electrolytic Capacitor Pack
250 capacitors in the one pack. Over $100 worth of RB & RT electro caps. Amazing value!
Cat R-7110

ONLY $9.95

HUGE SCOOP!

F'GLASS PCB 20" x 6" D/SIDED
Don't pay around $7 for a d/sided fibreglass PCB this size. We're offering them at less than HALF our competitors' prices! But you'd better hurry, stocks are limited! Cat H-5562.

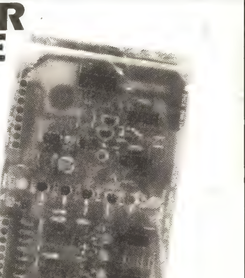
ONLY $2.95
WAS ~~$3.95~~

NEW!

4 SECTOR ALARM MODULE

Protect your home and valuables! Designed in Australia for Dick Smith Electronics especially to suit Australian conditions, this alarm can protect 4 areas at once, or independently of each other, or in any combination you desire. And just look at the features:
- Instant or delayed siren
- Built in siren sound generator will drive 2 speakers
- Adjustable entry, exit and alarm time periods.
- 'Wire out proof' sensing system
- Easy to install and operate

Cat L-5056
and it's only $59.50



WHY PAY MORE?

GET PRICES ON COMPONENTS LIKE YOU HAD A RELATIVE IN THE BUSINESS!!

Granny Smith

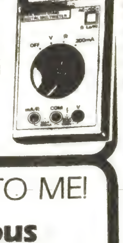
NOW A COMPLETE RANGE OF 100V GREENCAPS

We've now expanded our range of Greencaps to give you the best deal. Don't buy them elsewhere when you can get them at these ridiculously low prices.

Values in uF	Cat No.	Price 1-9	Price 10 up
.001	R-2010	25c	20c
.0012	R-2012	25c	20c
.0015	R-2015	25c	20c
.0018	R-2018	25c	20c
.0022	R-2020	25c	20c
.0027	R-2027	25c	20c
.0033	R-2025	25c	20c
.0039	R-2030	25c	20c
.0047	R-2035	25c	20c
.0056	R-2040	25c	20c
.0068	R-2045	25c	20c
.0082	R-2050	25c	20c
.01	R-2055	25c	20c
.012	R-2057	25c	20c
.018	R-2062	25c	20c
.015	R-2060	25c	20c
.022	R-2065	25c	20c
.027	R-2067	25c	20c
.033	R-2070	25c	20c
.039	R-2075	25c	20c
.047	R-2080	25c	20c
.056	R-2085	25c	20c
.068	R-2090	25c	20c
.082	R-2095	25c	20c
.1	R-2100	28c	23c
.12	R-2102	28c	23c
.15	R-2105	28c	23c
.18	R-2107	28c	23c
.22	R-2110	28c	23c
.27	R-2115	35c	30c
.33	R-2120	35c	30c
.39	R-2125	39c	34c
.47	R-2130	49c	38c
1.0	R-2135	$1.25	$1.15
2.0	R-2140	$1.25	$1.15
3.3	R-2145	$2.50	$2.20

Autoranging LCD Digital M/meter

YOU DON'T HAVE TO BUY 10!!



At last a fantastic full ranging budget priced multimeter! This LCD multimeter is a portable 3½ digit, compact sized tester ideally suited for anywhere. Cat Q-1446

ONLY $45.00

Compare our Fuse prices!

A full range of fuses in both popular styles: M-205 mini. (size approx 20mm x 5mm) and the popular 3AG (size approx 32mm x 6mm). Remember the lower current rating of the fuse you use, the greater protection it gives your equipment.

M-205 TYPE

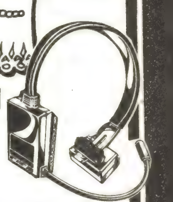
Rating	Cat No
250mA	S-4412
500mA	S-4415
1A	S-4421
2A	S-4423
5A	S-4425

3AG TYPE

Rating	Cat No
100mA	S-4449
150mA	S-4451
250mA	S-4453
350mA	S-4455
500mA	S-4457
1A	S-4461
1.5A	S-4465
2A	S-4467
3A	S-4469
5A	S-4471
7.5A	S-4473
10A	S-4475
15A	S-4477
20A	S-4479
25A	S-4481
30A	S-4485
35A	S-4487

ONLY 25¢ each

'HANDS OFF' COMMUNICATION FOR THE FIRST TIME!



The amazing Shuttlecock is a lightweight half-headphone which lets you communicate with people up to 400m away (even further if you use its tiny antenna)! You can use it on either ear and, with the VOX automatic switching system, you don't have to touch it to use it! When you talk, the Shuttlecock automatically transmits the message. Stop talking, and it goes back to receive mode. Ideal for construction workers, surveyors, security workers, hikers, skiers ...... Cat D-1150

ONLY $89.95 pr

DUE IN STOCK EARLY AUGUST

SPEAK TO ME!

SAVE UP TO 30%!

Famous Sennheiser Omni Mic's.

We're proud to offer this famous Sennheiser microphone at such an exceptionally low low price. This mic. represents outstanding value for money and comes complete with stand. Omni directional type Cat C-1021

WAS ~~$29.95~~ NOW $19.95

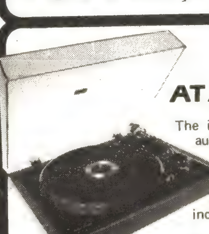
NEW M-205 HOLDER

This professional looking fuse holder will protect your fuse and give your project a 'finished' look. Cat S-4204

ONLY $1.10

LARGE RANGE OF OTHER HOLDERS TOO!

QUALITY BELT DRIVE AT A RIM DRIVE PRICE!

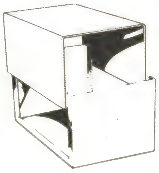


The ideal turntable for any Hi-Fi! A semi automatic belt-drive turntable with all the 'mod cons' such as variable speed control, strobes, damped tone arm with cueing lever, anti-skate, auto return, etc. etc.... And the price includes a quality magnetic cartridge! Cat A-3080

ONLY $169.00

⅓ OFF!

PROJECT CASES

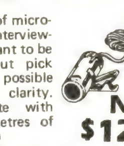


Just the shot for the weekend projects that get left lying around! Put them into an economical aluminium box! The boxes come in two pieces which slide together — they even come with screws to hold them together! Versatile and very useful — and in a wide range of sizes.

Size and Cat No.	Price	Now
102 x 51 x 70mm Cat H-2300	$2.25	$1.50
102 x 58 x 58mm Cat H-2310	$2.40	$1.80
127 x 58 x 58mm Cat H-2315	$2.50	$1.63
127 x 102 x 76mm Cat H-2320	$3.20	$2.07
133 x 76 x 54mm Cat H-2325	$2.75	$1.83
178 x 153 x 114mm Cat H-2335	$6.75	$4.50

BEAT THIS FOR SIZE!

TIE CLASP ELECTRET



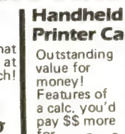
This is the type of microphone used by interviewers when they want to be inconspicuous but pick up as much as possible with perfect clarity. Comes complete with clasp and 6 metres of cord. Cat C-1060

NOW $12.50

WAS ~~$18.50~~ SAVE $6.00

The best of both Worlds!

Analogue/Digital Watch



No moving parts! 'Face' and 'hands' made from LCD's. Has an alarm with visual and audio warning and an hourly chime. Plus an attractive gold/silver band. Cat Y-1045.

~~$44.50~~ **ONLY $37.50**

APE TAPES AS SEEN ON TV!

Listen to well known personalities on a tape designed for most ans. machines.

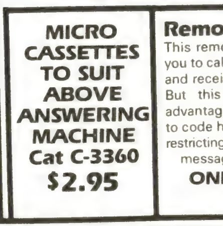
Cat Y2172

$8.95

FREE! ONE APE TAPE WITH EVERY ANSWERING MACHINE PURCHASED! Limited offer only

NEW DELUXE TWO TAPE ANS. MACHINE

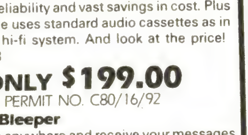
TELECOM PERMIT NO C81/16/85



Now you can have one tape for your incoming calls and one for the message. So convenient, so easy. You don't have to record your message up to 30 times now, only once. Cat Y-2180

ONLY $299.00

PHONE ANSWERING MACHINE



Don't pay over $400!

This amazing unit is so easy to install — simply plugs into the power and connects to your Telecom installed socket. Easy to use and offers incredible reliability and vast savings in cost. Plus this machine uses standard audio cassettes as in your home hi-fi system. And look at the price! Cat Y-2173

ONLY $199.00

TELECOM PERMIT NO. C80/16/92

Remote Bleeper

Call in from anywhere and receive your messages via the phone! Great! Cat Y-2174 .... only $49

MICRO CASSETTES TO SUIT ABOVE ANSWERING MACHINE

Cat C-3360

$2.95

Remote Bleeper

This remote bleeper allows you to call in from anywhere and receive your messages. But this bleeper has an advantage, it allows the user to code his bleeper, thereby restricting access to recorded messages. Cat Y-2181

ONLY $49.00

CALCULATOR BARGAIN TIME

Metric Conversion Made Easy!

Take the hardship out of metric conversion. LCD Calculator does it all for you plus it has all the regular features too! Cat Q-3025

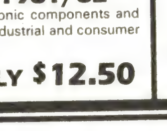
ONLY $19.95

Superslim Calc.

As small as your Bankcard! Carry it with you & you'll wonder how you ever did without it! Cat Q-3022

ONLY $9.95

WAS ~~$29.50~~



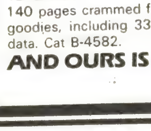
NEW LOW PRICE

Alarm Clock Calc.

Superb calc. that becomes a clock at the flick of a switch! Cat Q-3024

$19.95

WAS ~~$29.50~~



SAVE $10!

Handheld Printer Calc.

Outstanding value for money! Features of a calc. you'd pay $$ more for. Cat Q-3020

BATTERY OPERATED

SAVE $18!

ONLY $49.00

WAS ~~$67~~

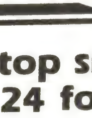
Paper to suit Cat Q—3021 ....60c

PHILIPS GENERAL CATALOGUE 1981/82

A complete listing of electronic components and materials for professional, industrial and consumer uses. Cat B-4010.

ONLY $12.50

AND DICKS' TOO!



140 pages crammed full of goodies, including 33 pages of data. Cat B-4582.

AND OURS IS ONLY 75¢

1982 National Semi-Conductor Linear Databook.

Handy reference book choc-a-bloc full of everything you wanted to know about popular linears. Cat B-4020

ONLY $13.50

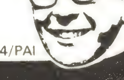
Getting To Know Personal Computers

This book takes the mystery out of computers and explains how the average person can use and enjoy them. Cat B-2350

ONLY $6.95

DICK SMITH Electronics

Your one stop shop for everything in Electronics
See Page 124 for address details



DSE/A314/PAI

New findings give rise to concern

Warning! VDUs may be a health hazard

With video display units becoming commonplace in offices and schools, many have voiced concern about harmful effects. What are the facts and what conclusions can we draw?

by Dr COLIN MACKAY*

ONE OUTCOME of the accelerating trend towards automation and putting computers to work for us has been a rapid growth in the number of video display units and business machines and word processors in which they are incorporated, often referred to as video display terminals (VDTs). Some experts believe that before long 15% of all workplaces will be equipped with systems that use VDUs (Video Display Units). Moreover, this proliferation is accompanied by an expanding diversity of applications, in which three basic categories of use can be identified; namely data entry, dialogue-type tasks and data enquiry.

In data-entry tasks, the VDU is used mainly when feeding a system with straight-forward data or, less often, text from documents such as invoices or other printed material, or even handwritten forms. This kind of task is usually intensive, which often means that operators use the VDU for most or all of the working day and gaze more at the source documents than at the screen or keyboard. Often they work at rates of 12,000 keystrokes per hour, or even faster. In the second, dialogue-type application the flow of information is both to the system, via the keyboard, and from the system via the screen; the volume of data input is considerably less than in data-entry tasks.

In data-enquiry work, data or text received from the computer and displayed on the screen has to be monitored and dealt with. In this task, and in data-entry work, the operator's gaze switches from source documents to screen and back again. One rapidly growing job is to obtain information from a computer to deal with enquiries made over a counter or by telephone, as for example in banks, ticket reservation systems and in handling orders for goods.

The spread of this technology has, inevitably, led to worries about the effect it might have on employment and health. Several health risks arising from the use of VDUs have been put forward and widely discussed.

Many people have been worried about the possible direct effects of VDU operation upon the operator, and especially about dangers to do with radiation and epilepsy. Operators themselves feel two main causes for anxiety: first, because they spend a large part of every working day close to the screen, they suspect that eventually they might suffer damage from exposure and that the dangers are not immediately obvious but are a hidden threat; second, reports have linked radiation with eye-strain and damaged eyesight, so it is understandable that the two have become inextricably linked in the minds of many users.

Radiation

Information displayed on a VDU is generated in much the same way as in a

---

Dr Mackay is a member of the Employment Medical Advisory Service of the UK Health and Safety Executive, London.

television receiver. An electron beam is accelerated by a high-voltage field and projected onto a fluorescent screen. Fluorescence is produced by a coating of phosphorescent material, known as the phosphor, deposited in a thin film on the screen's inner surface. The beam is made to scan the screen at a rapid but predetermined rate. When the electrons excite the posphor, visible light is given off. Variations in beam current affect the intensity, or brightness, of the images on the screen. Theoretically, all the energy of incident electrons should be converted into light but, in practice, the process is not perfect and energy at other wavelengths might be emitted.

It might also be thought that other electronic components in the display unit might radiate. Investigation of this has hitherto focused upon X-ray emission, but scientists are now taking an interest in the whole of the electromagnetic spectrum, including radiofrequency, microwave and ultraviolet radiation.

Surveys have been carried out in the UK and elsewhere to find out what levels of electromagnetic radiation come from VDUs. The most recent survey in the UK, made by the National Radiological Protection Board on behalf of the Health and Safety Executive, measured the emission in all parts of the electromagnetic spectrum from all types of VDUs produced or sold in the UK over a period from the last quarter of 1978 to the first quarter of 1980. The conclusion, in common with those drawn from other surveys, is that there is no significant radiation from VDUs when judged against national and international limits for continuous occupational exposure.

Photosensitive Epilepsy

Estimates of how prevalent photosensitive epilepsy is in the UK range from one in 5000 people to one in 10,000. It has been estimated that half the victims have their first seizure while watching television, and the most likely age for the onset is from 10 to 14 years; most of those who are likely to suffer an attack will have done so before the age of 20. So, the likelihood of a VDU causing the onset of such epilepsy is extremely low.

Fits can be brought on by straightforward intermittent photic stimulation (IPS), to use the technical term for normal exposure, or by viewing striped patterns. But estimates of how common the latter type of sensitivity is among epileptics in general, and among photosensitive people in particular, differ widely.

A number of factors appear to make the risk to photosensitive people greater than that from a domestic television set. They include, for example, a large screen, the frequency of scan-line interlacing, large amounts of bright text and prolonged viewing at close range. But, even with this information, and a knowledge of any person's history of seizures, it is doubtful that anyone could accurately assess the risk because there are not enough clinical statistics about the epileptogenic effects of VDUs. Nevertheless, people who suffer from photosensitive epilepsy should seek specialist medical advice before attempting to work with a VDU.

Facial Dermatitis

Recently, a number of VDU operators have developed a rash on the face. First reports of this came from Dr Hans Tjonn of the National Directorate of Labour Inspection in Norway. The operators complained of a prickling and itching sensation, "like insects crawling on the skin", mainly on the cheeks. A diffuse mild red rash with small surrounding areas of slightly raised flesh could be seen on the cheeks, forehead and neck.

So far, only a handful of VDU operators with such symptoms have been seen in the UK, and thorough measurement of radiation at their work stations has revealed that it is unlikely to be the cause. The trouble does, however, seem to coincide with low relative humidity and fields of static electricity from the VDU itself. At a relative humidity of more than 50%, the symptoms are less noticeable; arranging for static electricity to leak away and fitting anti-static carpets both seem to help. Work is now going on in several countries to elucidate the exact nature and causes of the symptoms.

Eye-Strain

Many unpleasant symptoms have simply been called eye-strain, covering a host of complaints to do with the way we see things. More properly termed visual fatigue, eye-strain is by no means a new phenomenon nor is it peculiar to VDU operators. Many industrial jobs make equally difficult and tiring demands upon the eyes and the rest of our visual system. Evidence from various sources suggest that about one-third of the working population suffers from this kind of stress. Recent studies assess it to be greater for people working with VDUs, but that depends on their particular tasks.

Symptoms of visual fatigue are many and various but, in the main, four groups of symptoms can be distinguished. The first group, ocular symptoms, are usually described as redness and soreness. Second, visual symptoms, include difficulties in accommodation, that is, adjusting the visual system to viewing things at different distances, and temporary blurring and visual confusion; spots, shapes in front of the eyes and chromatic effects surrounding viewed objects are reported, too. The third group, somatic symptoms, generally have to do with headaches and more diffuse pain in the face and neck. The fourth is one of behavioural symptoms, which show as things the operator does to make the screen more legible and to improve viewing conditions, such as fixing cardboard shields over the screen to give better contrast and sticking transparent coloured film over it.

Some theories attribute these symptoms of visual discomfort to strain in the muscles and around the eye, caused by trying to get a clearly defined image on the retina. But the physiological bases are not well understood and the condition cannot easily be separated from general fatigue. Combined with other evidence, this suggests that the symptoms may equally be due to psychological demands of the work and not merely to trouble with the visual system. Anxiety, too, often plays a part in visual fatigue, the "effort to see" having a lot to do with the will to work.

Eyesight Trials

Eye-strain is a word that implies some form of physical damage that may be irreversible but,so far as we understand it, visual fatigue is temporary and reversible. Dr Peter Gilbert of British Telecom has recently produced an interim report on trials of eye-sight for users of VDUs compared with a control group of non-users. Tests were made of unaided vision, visual resolution (that is, vision with the eyes corrected), spherical and cylindrical refractions, and the amplitude of accommodation. All the tests were done on each eye separately and, for the first two faculties, additionally on both eyes together. Average time between tests was 26.5 months.

INSTRUMENT CASE

Give your project a professional finish with this tough, high quality, German import instrument case.

$31.99 SUPER VALUE

MAGRATH'S AUGUST MONEY SAVERS

SEMICONDUCTORS

See 6-Pack Specials for super prices on asterisked products.

4011B	19c
*4016B	30c
4023B	19c
4028B	55c
*4066B	44c
*4511B	69c
4520B	74c
7406	20c
7414	33c
74164	48c
74365	37c
*74LS00	20c
*74LS04	20c
*74LS14	40c
74LS47	72c
*74LS90	42c
74LS161	53c
81LS95	87c
81LS98	88c
LM301A DIP	35c
LM308 DIP	49c
*LM324	42c
LM339 DIP	42c
*LM340KC.12	$1.20
*LM340T.5	51c
LM340T.15	60c
LM386N	60c
LM555	25c
LM741N DIP	23c
LM741 DIP	36c
*74C00	20c
*74C04	20c
*74C02	20c
74C89	$1.50
*74C107	30c
*MV5053S LED	7c
*IN4002	5c
*IN4148	4c
*UA317UC REG.	$1.20
*UA348PC OP AMP	85c
*PN2222A	5c
*KBPC602 6A 200V BR.	$1.00
*S6006L 6A 600V SCR	80c

MAGRATH'S 6-PACK SPECIALS

6 for the price of 5

DIGITAL & LINEAR

6×4016B	$1.50
6×4066B	$2.40
6×4511B	$3.45
6×74LS00	$1.00
6×74LS04	$1.00
6×74LS14	$2.00
6×74LS90	$2.10
6×LM324	$2.10
6×LM340KC-12	$6.00
6×LM340T-5	$2.55
6×UA317UC Regulator	$6.00
6×UA348PC Op Amp	$4.25
6×74C00	$1.00
6×74C107	$1.50
6×74C04	$1.00
6×74C02	$1.00

LEDs

6×MV5053S	35c

BRIDGES

6×KBPC602 6A 200V	$5.00

SCRs

6×6006L 6A 600V	$4.00

DIODES

IN4002 100 per pack	$4.50
IN4148 100 per pack	$3.50

TRANSISTORS

6×PN2222A	25c

TANTALUM CAPACITORS

QUALITY KEMET RESIN DIPPED ALL 20% TOLERANCE

		NORMAL PRICE EACH	SPECIAL PRICE PER PACK OF 6
0.33 uFD	35V	6c	30c
0.47 uFD	35V	11c	55c
1.5 uFD	35V	12c	60c
3.3 uFD	35V	12c	60c
6.8 uFD	35V	25c	$1.25
10 uFD	35V	29c	$1.45
22 uFD	25V	81c	$4.05
4.7 uFD	20V	15c	75c
10 uFD	16V	16c	80c

ELECTROLYTICS	NORMAL PRICE EACH	SPECIAL PRICE PER PACK OF 6
10 Mfd 25V RB's	16c	80c
25 Mfd 25V RB's	17c	85c
47 Mfd 25V RB's	22c	$1.10
100 Mfd 25V RB's	26c	$1.30
220 Mfd 25V RB's	36c	$1.80
POLYESTERS		
.001 Mfd 100V Greencaps	8c	40c
.0047 Mfd 100V Greencaps	8c	40c
.01 Mfd 100V Greencaps	14c	70c
.1 Mfd 100V Greencaps	14c	70c
HARDWARE		
RCA Plugs	20c	$1.00
RCA Chassis sockets	35c	$1.75
3.5mm Plugs mono	20c	$1.00
3.5mm Chassis sockets	35c	$1.75
MS102 Push to make switch	35c	$1.75

Hurry — while stocks last

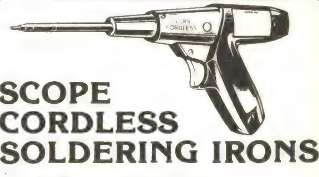
ELECTRICAL INTERFERANCE UPSETTING YOUR CIRCUITS?

The Bulgin mains filter protects personal micro's and any other TTL, CMOS or memory circuits.

- ☐ Incorporates 3 pin mains inlet connector
- ☐ Fully screened.
- ☐ Conforms to British & European specifications.

3 Amp & 6 Amp $14.00
10 Amp $17.00

MAGRATH'S EXCLUSIVE



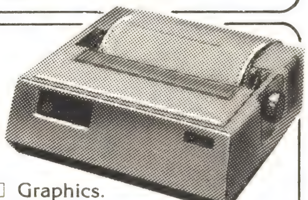
SCOPE CORDLESS SOLDERING IRONS

- ☐ **6 Second heating**
- ☐ **Totally portable**
- ☐ **60 Watt**

Recharge overnight from auto cigarette lighter or charger.

$58.28

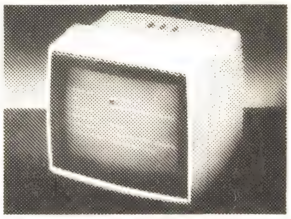
UNBEATABLE PRINTER VALUE FOR YOUR TRS80™ or APPLE® MICROLINE 82A.



120CPS Serial Dot Matrix Printer.

- ☐ Head life 200 million characters.
- ☐ Dual interfaces — Serial & Parallel.
- ☐ 80 column standard characters.
- ☐ 132 column with condensed characters.
- ☐ Graphics.
- ☐ Uses plain paper.

Unbeatable value $825
Also Microline 80 $495.00

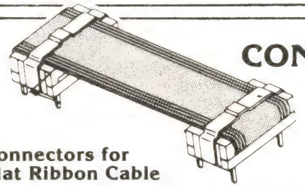


Low Cost Video Monitor — not a converted TV set.

18 MHZ Video Bandwidth Special at $230

The KG12CBLP is a green phosphor video monitor.

- ●Excellent resolution.
- ●Display format 80×24 lines.
- ●1.0 volt peak-to-peak composite.
- ●Negative video input signal.
- ●Interfaces to most personal and small computer systems.



CONNECTORS & CABLE

Connectors for Flat Ribbon Cable

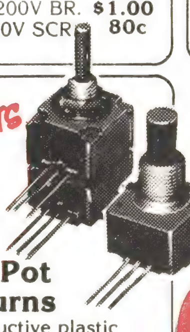
FRC-D14-30 14 Way	Dip Connectors	0.70c
FRC-D16-30 16 Way	Dip Connectors	0.70c

SUITABLE FOR DIP SOLDER OR IC SOCKET CONNECTION.

RAINBOW Flat Ribbon Cable For Your Flat Ribbon Connectors

14 Way	$1.00/M
16 Way	1.14/M
25 Way	1.79/M
26 Way	1.86/M
34 Way	2.43/M
40 Way	2.86/M

HI FI ENTHUSIASTS



NEW Modular Pot from Bourns

Features conductive plastic element for low noise. 5/8" Square. Single or Dual with bushing or PCB mounting, Linear and Audio tapers.

MODEL 91/92
250 ohm to 5 meg ohm.
SINGLE **$1.60**
DUAL **$2.50**

QUALITY & VALUE

EA-3

SEAL OF SATISFACTION
MAGRATH'S
WORLD OF ELECTRONICS

DATA...DATA...DATA...

THE LATEST DATA BOOKS

Fairchild	
T.T.L. Fast	$9.50
MOS Memory	$8.00
Bipolar Memory	$8.00
CMOS	$9.00
National	
Memory	$7.00
Voltage Regulator	$8.00
Reliability Handbook	$16.00
Audio Radio Handbook	$8.00
Data Conversion & Acquisition	$8.00
Hybrid Products	$8.00
Logic Data	$9.00
Linear Data Book	$9.00
International Rectifier	
Hexfet Data Book	$3.50
Semiconductor Data Book	$7.50
Philips Gen. Cat.	$10.00
Teccor SCRs & Triacs	$3.50
A.N.D. LCD Displays	$4.95
Bourns Trimpot TR2	$3.50

J.H. MAGRATH
208 Little Lonsdale Street,
Melbourne, Vic., 3000.
Telephone: (03) 663 3731

Add Sales Tax if applicable
Prices valid until stock sold.
Prices subject to alteration

bankcard welcome here

The conclusion drawn from a careful analysis of the data was that "very little change" had taken place in either the test or control groups. What difference there was between tests and controls could have been attributed to limitations in the precision of the measurement techniques. It is concluded that using VDUs in the way the operators did in the trial is unlikely to be harmful. In that type of work, VDUs were used for only relatively short periods but, so far, no adverse effect has so far arisen from more prolonged use such as in editorial applications.

Nevertheless, VDU operators do complain of visual fatigue. What, then, is the cause? Generally, such trouble results from difficulties in seeing and reading information displayed on the screen. This in turn has to do with how good the image and the ambient lighting are, the operator's eyesight and the ergonomics of the job. Many things affect image quality, some of which have a marked effect on legibility. Ideally, the display should be clear and sharp. Every character should be clearly distinguishable from all the others and the spaces between should be enough for words and codes to be read easily. Operators should be able to control the brightness of the characters and the contrast, separately. In practice some displays are prone to flicker, jitter, or other instability of the image, which have a very bad effect on legibility and should be cured.

Careful attention should also be given to creating suitable visual surroundings. The VDU image is generated within the device, so the light falling on the screen from outside the unit needs only to be good enough for its purpose and certainly not too bright. Screens should be shielded from any glare from nearby windows and lighting systems, which may cause troublesome reflections. This sort of nuisance is often noticed when VDU screens face sunlit windows or are at an unsuitable angle to rows of fluorescent lights. The aim should be to avoid high-luminance areas and reflections by keeping the lights down to a suitable level and making use of curtains and blinds to avoid bright light in the visual field of the operator. Special filters may also go some way to reducing reflections.

Postural Fatigue

Operators' posture, which has a big effect on their comfort and efficiency, depends mainly on the nature of the job and the design of the workplace. When these are not in harmony, postural fatigue often sets in. Here, too, there are various reasons why problems may arise. One important thing to be considered when a terminal is in use over a long time is static posture. Under normal circumstances, for most of the time the person is fairly free to move and makes voluntary and involuntary adjustments of posture to shift the load between groups of muscles. A workplace that is badly designed prevents this happening and leads to a rigid constrained posture. The design should make it easy for the operator to move, and even encourage movement by allowing frequent changes in work routine.

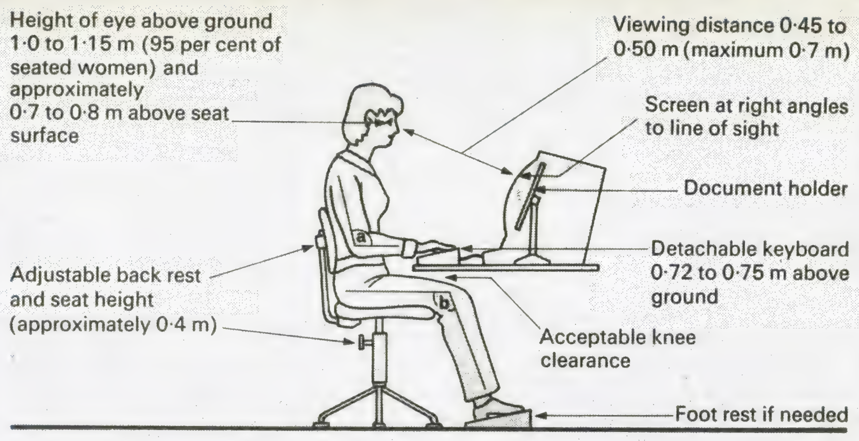

Height of eye above ground
1·0 to 1·15 m (95 per cent of seated women) and approximately 0·7 to 0·8 m above seat surface
Viewing distance 0·45 to 0·50 m (maximum 0·7 m)
Screen at right angles to line of sight
Document holder
Detachable keyboard 0·72 to 0·75 m above ground
Adjustable back rest and seat height (approximately 0·4 m)
a
b
Acceptable knee clearance
Foot rest if needed

Fig. 1: Suitable posture for VDU use. Support for back, thighs and feet are particularly important. Angles (a) and (b) at elbows and knees, should be about 90°C.

Workplace design is a complex subject but several basic suggestions can be made. The ideal sitting position is shown in Fig. 1; it calls for adjustable seating, thin desk tops, foot rests and detachable keyboards. A document holder obviates undesirable turning and stretching and cuts out a lot of the changes in visual accommodation that otherwise might be necessary when switching the gaze to and fro between screen and documents. The area of the desk and other work surfaces should afford ample space for documents, trays and so forth.

Stress and Well-being

One of the main advantages of VDU-based systems is that they allow the user to interact with and interrogate the computer. Professional groups such as scientists, administrators and to a lesser extent journalists use such equipment in this way. While this kind of application is becoming widespread, systems in which the VDU is being used for simpler tasks are proliferating, too. A lot of routine clerical jobs have been computerised but many of them are nevertheless still monotonous and repetitive. Moreover, changing a job to suit the new technology often means that it calls for less skill. Such developments are probably at the root of many reports of boredom and dissatisfaction, and of reports that the well-being of operators has suffered, coupled with symptoms of postural and visual fatigue, particularly by staff engaged in direct data-entry.

There is, too, an issue over the way the computer can control the operator's work. It is apparent in several ways. First, in certain systems the processing power of the machine is exploited to such an extent that it can monitor the operator's minute-to-minute keying performance. In many instances this information affects wages, through piece-rate payment. Not unnaturally, such a degree of control is often resented, regarded with suspicion by many operators and, understandably, associated with feelings of fatigue and stress. Second, very long response times from the computer, or times that vary in length, create uncertainty and frustration. Third, technical disturbances and breakdowns, if they happen often, serve only to exacerbate the problems.

One solution has been to introduce fixed rest breaks and to restrict the number of hours an operator can work each day at a VDU. Where the job consists entirely of intensive entry of data, rest breaks should prevent rapid build-up of fatigue. Breaks should be taken before fatigue sets in, not to recuperate from it; short breaks at frequent intervals seem to be more satisfctory than longer, occasional ones.

A better solution, which would avoid having to set fixed breaks, would be to design VDU-based tasks in such a way that spells of concentrated work at the device were spread out at intervals throughout the working day. During the rest of the time the operator would do some other kind of work. Giving the user a degree of discretion over how the work is allocated through the day gives a greater sense of personal control and allows for differences in individual needs for brief pauses in the work.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

PANIC STATIONS SELLOUT!

Having just concluded stocktake we now have our $1/3 million of electronic components and products — it's all great stuff — like our new range of Carbon Steel Electronic tools, Multimeters, OEM Grade Passives, Plugs, Sockets, Switches, Speakers, Microphones etc. — all freshly arrived from our overseas suppliers.

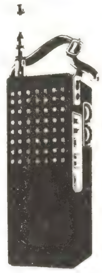
BUT ALAS! *Our heartless accountant insists we reduce our stocks by $50,000 this month — so out it goes — so here's your chance to save a bundle . . . Cheers* Jack O'Donnell

INCREDIBLE AM/FM CAR STEREO OFFER

$99
RECEIVER & SPEAKERS!
Speakers FERRIS WIDE RANGE TWIN CONE 10 watts max With grills and cables
Experience our FM STATIONS with crystal clear reception, and 7 WATTS of power per channel!
Integrated Silicon Chip Technology
CAT A 9120
FM 88 92 96 102 108 MHz
AM 54 6 8 10 14 16 KHz
FM FM FM AM AM

SAVE $50 NOW ONLY CAT C9990 **$49**

VIVANCO 2.5 WATT



Quality Japanese design handheld. Includes carrycase and shoulder strap. Specifications: Two channel mode, channel 1 27.240 MHZ channel 2 unfitted, superhet RX with RF stage, variable squelch, IF 455 KHZ, modulation P-P High level class B, TX OP power 1 watt RF, RX sensitivity 1 UV at 10 db SNR. Power source 8 AA penlight or external 12V DC. Accessory jacks — earphone, 12V Input, battery charger Input.
Dimensions 180 x 65 x 50

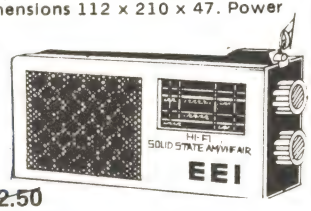
Why not get one for the boat? It's cheaper than a second motor. Please nominate marine version (Chan. 1 fitted with 27,880 XSTAL).

D 2500 (27.240 MHZ)	**$59.50**
D 2502 (27.880 MHZ)	**$59.50**

AM-AIR BAND PORTABLE RADIO

Covers normal AM broadcast band plus 108 to 174 MHZ. Specifications 10 transistor 7 diodes 450 MW output, separate RF stage for High Sensitivity. Dimensions 112 x 210 x 47. Power source 4XAA.

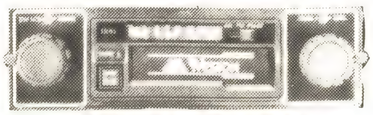
A great little 2 metre monitor covers commercial bands and weather-band.



A 0075 ~~$22.50~~
NOW JUST $19.95

AM/FM CASSETTE C 9120

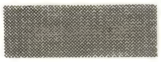
★ Quality AM/FM receiver ★ Sensitivity 3UV FM, 10 UV AM ★ 6 watts per channel power output ★ 33-10 KHZ frequency response ★ Wow and flutter less than .2% ★ Output impedance 4-16 OHMS ★ Power source DC 13.2V neg. ground 350 MA No. sig. to 2.5 amps. Both channels fully driven.



NOW JUST $69.00
30 ONLY AT THIS PRICE

VERO TYPE STRIP BOARD

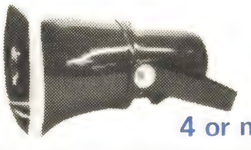
Alpha numeric grid
Pre drilled .9 mm, 2.5 mm spacing, 95 mm wide



H 0172 150mm L	**$1.50**
H 0174 75mm L	**$1.00**

15 WATT 8 OHM

Fully weatherproof. Rectangular aluminium flare. Public Address Speaker

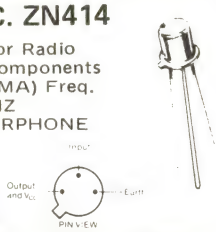


NOW $19.50

4 or more $18 each

TRF RADIO I.C. ZN414

Equiv. to 10 Transistor Radio with just 7 external components (inc. battery - 1.5V 3MA) Freq. Range 150 KHZ-3MHZ
DIRECT HIGH Z EARPHONE O/P DRIVE



Were ~~$2.95~~
NOW JUST 95c

Includes **DATA SHEET** and circuit diagram.

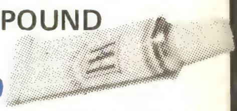
Heard about our Overnight Jetservice Delivery?

Many 1000's throughout Australia have (and to these good people — our sincere thanks). But we believe there are some of you who baulk at the idea of dealing with a company on the other side of Aussie, presumably you may feel that we'll be slow delivering or the like — Well let's dispel that once and for all!!!

A Promise — Nominate Jetservice with your order and we guarantee to deliver your order faster than any other Australian supplier. It doesn't matter whether you live in Mt. Isa or North Ryde, we guarantee to be quicker and more efficient.
If we fail — you may return your order to us and we will refund your full purchase price plus $5.00 for your trouble*.

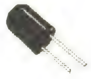
*Offer is made in good faith and subject to stock availability.

HEATSINK COMPOUND



H 1600 . . . . . ~~$1.25~~
NOW JUST $1.00

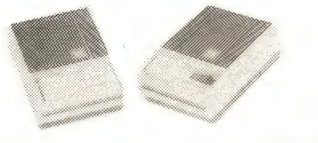
INFRA RED LED / FLASHING LED



INFRA RED LED	FLASHING LED
Z 0172	Z 0159
NOW 45c ea.	40c 10 up

TWO STATION INTERCOM

Battery Operated



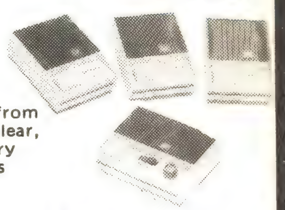
Call tone from either station in off mode. Clear, crisp audio. Ideal for home, office etc.

A 0470 . . . . NOW $12.50 PAIR

FOUR STATION INTERCOM

AMAZING VALUE!

Master Plus
3 Slaves



Call tone facility from Slave to Master. Clear, crisp audio. Battery operated. Includes wire.

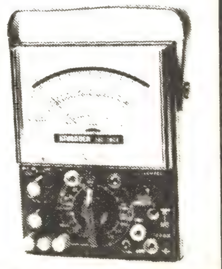
A 0475 . . . . NOW $25.00 SET

LABORATORY MULTIMETER 100K OHMS/VOLT

CHECKS TRANSISTORS AND MEASURES CAPACITANCE

From Tokyo Laboratories, Japan

Remember the days when high grade precision laboratory multimeters were available only from UK and then they cost a King's Ransom?! — Well, that's history — The new Q 1040 is everything a high quality meter should be **PLUS** it checks transistor HFE and ICO and measures capacitors from 50 pf—50 UF.
★ 100K OHMS/Volt DC ranges ★ 8.5 UA movement ★ Fuse and diode movement protected ★ Inbuilt oscillator for capacitance measurement.
RANGES: DCV 250MV, 2.5V, 10V, 50V, 250V, 1000V. **ACV** 5V, 10V, 50V, 250V, 1000V (10K/V) **DCA** 10UA, 2.5MA, 25MA, 500MA, 10A **ACA** 10A **Resistance** x1, x10, x1K, x10K **Transistors** NPN/PNP **HFE** 0-1000 **ICO** 0-50UA **Capacitors** 50PF-3UF. .01UF-50UF.

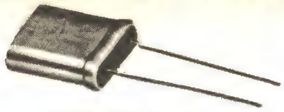


Q 1040 Multimeter	$72.50
Q 1041 Carry Case.	$14.50

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...



CRYSTALS

3.7598 MHZ XSTAL as used in clock modules, counters etc.

Y 1010 . . . . $1.50 ~~$3.00~~

10.000 MHZ XSTAL parallel resonant, low age rate, as used in EA digital frequency counter project and microprocessor projects.

NOW ½ PRICE $4.75

Y 1020 . . . . ~~$9.50~~

KEY OPERATED SWITCH

19.5mm mounting hole required. Supplied with two keys. Hundreds of applications for security type applications.

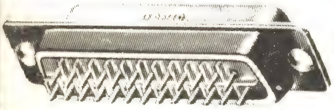
S 2500 . . . . ~~$6.95~~

NOW ONLY $5 EACH

D25 SERIES CONNECTORS

Universal 25 Pin Computer Series

P 0900 Male 25 Pin	~~$5.50~~	NOW $3.95
P 0901 Female 25 Pin	~~$5.50~~	NOW $4.50
P 0905 Backcover	~~$3.50~~	NOW $2.50

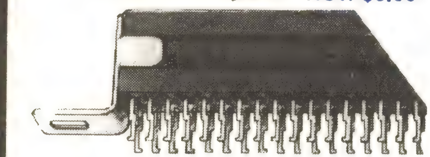


SAVE NEARLY 30%

.1 INCH PITCH EDGE CONNECTOR

Supplied with mounting feet and polarizing key.

P 0940 16 Way	~~$2.40~~	NOW $2.00
P 0945 24 Way	~~$3.60~~	NOW $3.00



12 VOLT IRON

Works off 12V car battery. (Comes fitted with lighter plug). AND just as well off 12V AC. Use M2156 Transformer in H0442 Box and Presto you have a low cost mains isolated iron!

OUR PANIC SELLOUT PRICE $3.00 ea.

T 2512 . . . . ~~$3.95~~

XENON TUBE

As used in strobe projects etc.

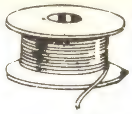
S 4050 . . . ~~$2.95~~

NOW $2.00

TRIGGER TRANSFORMER

For S 4050

M 0104 . . . . ~~.95~~ **NOW 60c**



TINNED WIRE

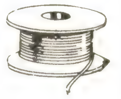
22 gauge
100 gram Reel

W 0320 . . . . . . **ONLY $2.50**

HOOK UP WIRE BARGAINS

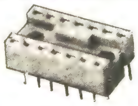
Quality tinned 13/.12mm H/U wire available in 8 colours. On 100m reels.

- W 0250 Red
- W 0251 Black
- W 0252 Brown
- W 0253 Orange
- W 0254 Yellow
- W 0255 Green
- W 0256 Blue
- W 0257 White



ALL JUST $3.95 ea. or eight reels for $30.00

Fantastic Value!



IC SOCKETS DIL

LOW PROFILE

		PRICE	NOW
P 0550	8 Pin	~~.25~~	.15
P 0560	14 Pin	~~.30~~	.20
P 0565	16 Pin	~~.30~~	.20
P 0567	18 Pin	~~.40~~	.25
P 0570	24 Pin	~~.60~~	.40
P 0575	40 Pin	~~.80~~	.50

HEAVY DUTY TOGGLE DPDT CENTRE OFF

125V/10A (250V AC/5A)

Ideal for car antenna switch, automotive and marine electrical use.

NOW JUST $1.50 each

S 1055 . . . ~~$1.95~~

9V AC ADAPTORS

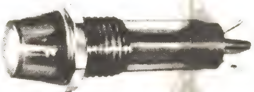
150 MA

SEC APPROVED

$4.00 each

12V PANEL LAMPS

SEALED PVC CONSTRUCTION



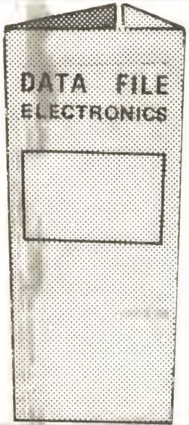
S 4025 (Red) . . . ~~.65~~
S 4026 (Green) . . ~~.65~~

NOW 50c each

VINYL BINDER

Holds 12 magazines, each on a spring out wire rod. Just the shot for each year's set of Electronics Australia, ETI or any of your favourite magazine.

Suits all A4 size publications (275 x 210). Very smart Royal Blue colour with beautiful gold embossing.



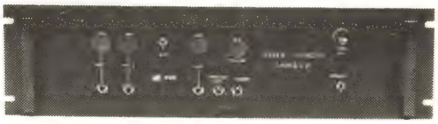
B 9999 . . . ~~$5.50~~

THIS MONTH $4.50 each
4 or more $4 each

GREAT NEW MOSFET PA AMPLIFIER KIT FROM ETI

150 watts power output.

See June '82



UNCONDITIONALLY STABLE - SOUND STUDIO SPECIFICATIONS

OUTPUT IMPEDANCE Selectable to low Z voice coil or 100V or 70V line out.

INPUTS 2 mic inputs HI or low Z with speech filter.
1 Aux. input.

- ★ Low noise 5534 op amps used.
- ★ Noble W/wound power resistors used in output stage for guaranteed stability.

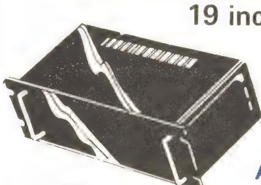
★ ★ ★ ALTRONICS EXCLUSIVE ★ ★ ★

All due respects to ETI, but we felt the original case was lousey — So we've brought out ours utilising our snazzy H 0400 Black Rack Cabinet.

It looks terrific!! And for this month only, it's the same price as the original version.

K 5035 . . . . **ONLY $239.00**

EGAD!! We are even discounting our 19 inch RACK BOX



132 mm High

Black Finish

50 ONLY AT THIS PRICE!

H 0400 . . . . $35.00

HOW'S THIS . . . . . . BUX 80's

Incredibly Low $5.00 each

NEW 24 HOUR 7 DAYS P/WEEK PHONE ORDER SERVICE FOR BANKCARD HOLDERS

Take advantage of "off peak" low STD phone rates and phone your order to our new recorded 24 hour order service. Give your name, address with postcode, phone number, bankcard number and expiry date then your order—and presto your order will be processed and back to you in a flash—Please nominate Jetservice if you want overnight delivery.

$2 Delivery Australia Wide: We process your order the day received and despatch via Australia Post. Allow approx. 7 days from day you post order to when you receive goods. Weight limited 10kgs.

$4 Delivery Australia Wide: We process your order day received and despatch via Jetservice for delivery next day.

Bankcard Holders can phone order up to 8pm (EST) for next day delivery — Sounds incredible doesn't it? Alright you cynics just try us! Weight limit 3.3kgs. Jetservice cannot deliver to P.O. box numbers (Australia Post would have a fit!)

ALTRONICS
105 STIRLING ST., PERTH
FOR INSTANT SERVICE
(09) 328 1599

All Mail Orders:
Box 8280 Stirling St.,
Perth WA 6000

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS .. ALTRONICS .. ALTRONICS

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Starlab: a telescope in orbit

A Space Shuttle mission of the future could hold major interest for Australia. With Canada and the US, Australia may sponsor "Starlab", an orbiting telescope.

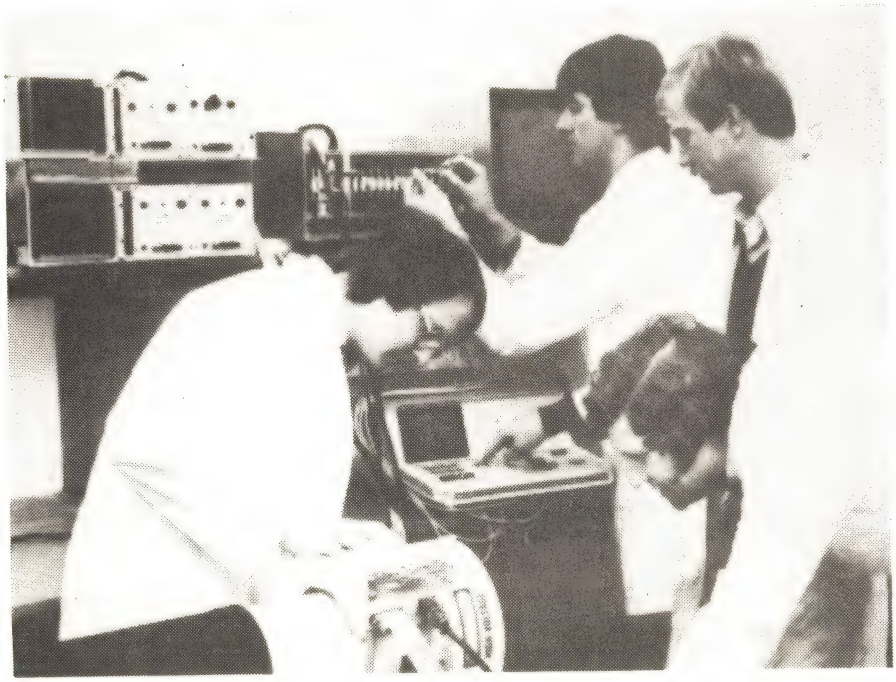
Originally a NASA project in its entirety, Starlab was on the point of being abandoned due to budget cuts when Canada and Australia became interested. The result is a tripartite international project which should see Starlab launched into orbit aboard the Space Shuttle by the end of the decade.

But Australia has a much greater interest in the project than simply the funds it will contribute and the ultimate scientific knowledge it will reap. If all goes as planned, Australia will make a practical technological contribution which has helped to change the whole concept of the mission.

As originally envisaged by NASA, Starlab was to be attached to the shuttle and would remain in orbit for the duration of each shuttle flight, between seven and 14 days. The images collected by the telescope would be recorded directly on photographic film.

Later, NASA suggested a much more elaborate plan. They envisage that a space platform will be available by 1989 and, by mounting Starlab on the platform, it could remain in orbit from six to 12 months at a time. It could thus have a life of about ten such missions, spread over 15-20 years.

However, the success of such an approach depended on the availability of a suitable electronic image recording system in place of the original photographic system. And this is where Australia's contribution comes in. The Mount Stromlo and Siding Spring Observatories have developed a detector (the Large Area Format Photon Counting Array, or PCA) capable of a very high order of performance.



Mount Stromolo engineers test the prototype Large Format Photon Counting Array.

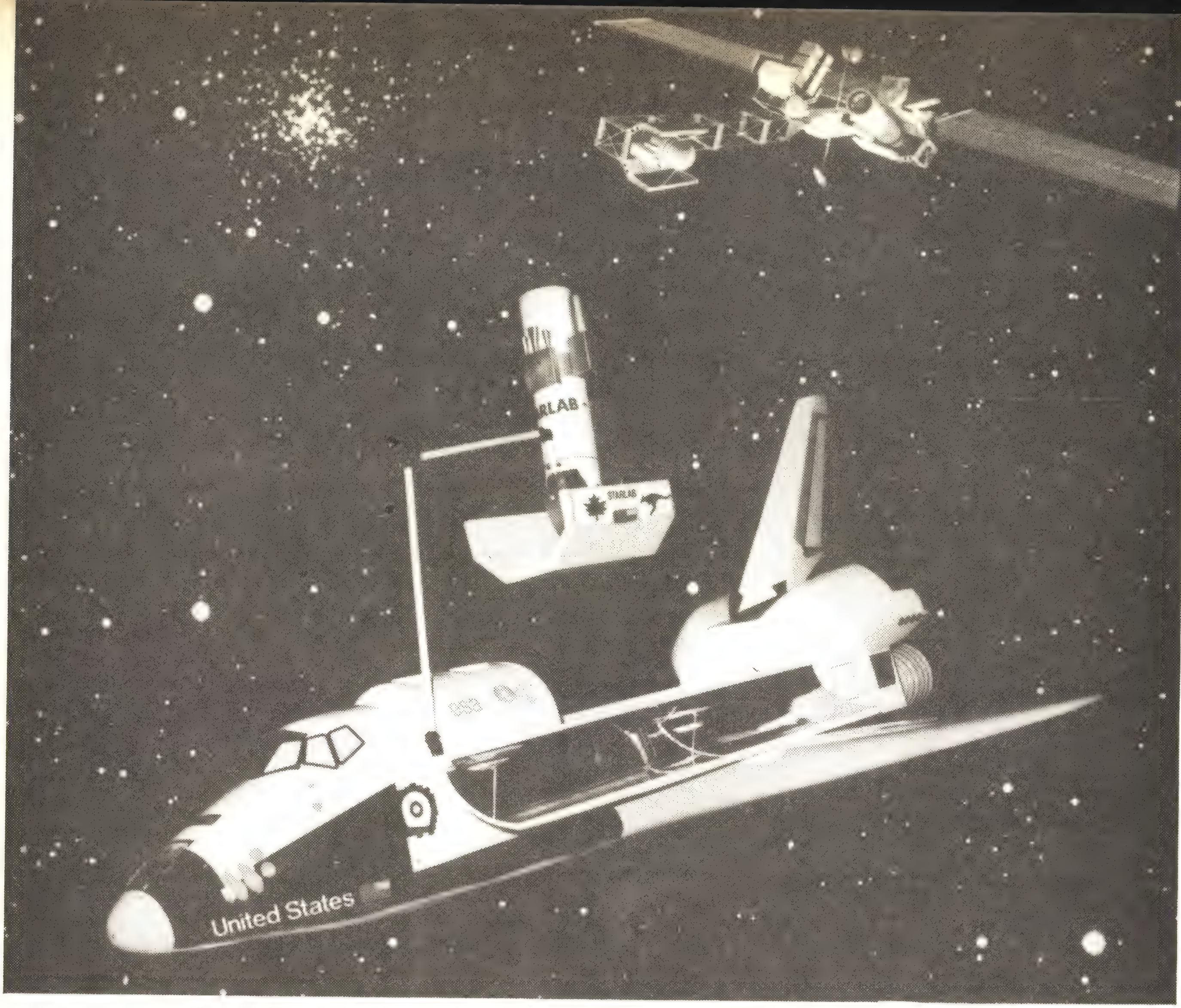
This was the breakthrough that NASA needed and, while one other system was being considered, it is now virtually certain that the Australian system will be used. One NASA official has described it as ". . . two years ahead of any other system in the world."

In greater detail, Starlab will be a unique orbiting astronomical laboratory. It is designed to operate from the ultraviolet to the infrared region of the spectrum and will be capable of high resolution imaging and spectroscopy over a wide field of view.

Current plans call for a 1m aperture telescope in conjunction with the photon counting array already mentioned, and a spectrograph. Signals from these two detectors will be processed and fed to a memory, where the data will be accumulated during an exposure period. The complete images will then be recorded on tape for transmission to Earth each day.

Starlab is actually one of two orbiting telescopes planned by NASA, one being designed to complement the other. The second is called, simply, the Space Telescope. It is to have a 2.4m diameter aperture, with a maximum field of view of only 2.7 min-arc. Starlab is a wider field instrument, with 20 min-arc, and covering nearly 100 times the area.

Starlab will orbit 450km above the earth; a box seat position from where it can view the universe without the losses and distortions created by the Earth's atmosphere. One such loss is in the ultraviolet wavelengths, which are blocked by the atmosphere. Other losses are



An artist's impression of Starlab being lifted out of the Space Shuttle and placed on an orbiting Space Platform.

caused by light scatter, atmospheric pollution, and turbulence.

Such are the advantages of a telescope in space that the 2.4m instrument previously mentioned will be able to study galaxies possibly 50 times fainter than celestial objects now observed. Light sources up to 14 billion light years away will become accessible; a seven times greater range than that of the largest ground based optical telescope, the 5.1m diameter Mount Palomar instrument.

Access to the ultraviolet spectrum is also vitally important, since it is here that the strongest emissions from the basic elements hydrogen, helium, carbon, nitrogen and oxygen occur.

Construction, as well as cost, will be shared between the three countries. The telescope will be built by Canada, while Australia will develop the advanced instrument package to go with it, including the PCA detector system.

Australia may call on the French company S.A. Matra to assist in developing the instrument package and detector system. S.A. Matra is one of Europe's largest and most diversified high technology group of companies. Their activities include, among many others, telecommunications, satellites, data processing, optics, and electronic components.

Instrument package

The instrument package will be divided into three main modules: the camera assembly, guidance electronics and a memory system. The camera module is located at the focal plane of the telescope and consists of a direct imaging camera, an ultraviolet spectrograph and a mode selector for directing the beam of the telescope to either of the two instruments. At the moment, plans call for a single calibration package to calibrate the response of both instruments.

Both the direct imaging camera and the UV spectrograph have their own detector. Each detector consists of a photon counting array using an image intensifier coupled by specially shaped optical fibres to an array of Charge Coupled Device (CCD) video sensors. Image acquisition and processing sections provide amplification and conversion of the analog signals from the CCD sensors to digital signals which can be processed to provide the required resolution of the telescope.

Accumulating photon pulses represented by the digital information are stored in a memory module to build up the image seen by the detector. The memory storage available is huge, consisting of 37.5 million words, with each word containing 16 bits of information. Physical size and power consumption of this memory module will be one of the critical design features of Starlab.

The guidance electronics system consists of a fine guidance sensor which is used to achieve final pointing of the telescope, with very high accuracy, by tracking reference stars in its field of view.

The cost of the complete space observatory is to be shared between Canada and Australia. It is estimated to be $A47 million, of which Australia's share would be $A23.5 million.

The American contribution, via NASA, will be to develop the space platform to carry the laboratory, and to bear the cost

Three practical magazines with practically everything for the practising electronics buff.

PRACTICAL ELECTRONICS
MAY 1982
Easy to build projects for everyone
MAY 82
70p
Everyday ELECTRONICS
MAY 1982
75p
Practical Wireless
FOR THE RADIO ENTHUSIAST...
World Amateur Radio Callsign Prefix Map
PULL-OUT EXTRA INSIDE
PW f.m. mains intercom
PW RADIO USERS
ANNOUNCING INSURANCE SCHEME
and THE REVISED UK AMATEUR LICENCE

Practical Electronics:

If you want to know how things work and how to build them, this is your magazine. The May issue has a special supplement on automatic test equipment, part two of building a stereo cassette deck, five other construction projects and much, much more.

Everyday Electronics:

A mixture of projects, theory and popular features. In this month's issue, Everyday Electronics give you a complete guide to discrete and integrated semiconductors as well as instructions for six exciting projects.

Practical Wireless:

Features many interesting how-to projects and plenty of theory to keep you up to date. In the latest issue of Practical Wireless, there's a special lift-out World Callsign Prefix Map for amateur radio operators and complete instructions to build an FM mains intercom.

ON SALE NOW!

West Australian readers please note — if these issues are not available, get your newsagent to back order.

IPCP0761

of the first two launches. All three countries will share equally in time of access to the telescope.

Benefits

As well as the direct scientific benefits which Australia would reap from the project, Australian scientists backing the project point out that there would be substantial industrial spin-offs for Australian manufacturers and the work force. They regard it as a starting point – a seed – from which a much larger Australian space industry could grow.

At the same time, they are apprehensive about the Federal Government's willingness to continue funding the project. In fact, there will be no firm commitment by any of the three countries to complete the project until 1984, by which time a decision will be needed to achieve a launch date of 1989.

But, to facilitate the 1984 decision, a lot of work and feasibility investigation will be necessary before that date, and funding for this is crucial. Much depends on the Government's attitude, and the funds allocated, at the time of the 1982 budget.

N66, a feature of the Small Magellanic Cloud, taken with the Photon Counting Array on the one metre telescope at Siding Springs Observatory, Coonabarabran, NSW.

Australian participation

A report of the Astronomy Advisory Committee to the Australian Government states: "Such is the importance of space to astronomy, in fact, that if Australia does not participate prominently in space astronomy programs, we can resign ourself to becoming second rate in astronomical research. We consider Starlab to be an exciting opportunity to enter the space astronomy field in a major way."

The development of the Starlab instrument package calls for the integration of standard components produced overseas into a unique assembly. Many of the optical, mechanical and electronic assemblies are within the competence of local industries. The improvements in the facilities for manufacturing which would be necessary to make the assemblies spaceworthy would be a permanent benefit to Australian high technology industry.

Once Australian industry develops a space capability by participation in the Starlab project, local participation in the next generation of satellites and ground stations for communications, resource management, weather monitoring, and scientific research would be feasible. As the operational life of satellites is around five to ten years, replacements are required regularly. Australia should aim to have the capability to substantially design and build such equipment locally, to our own requirements.

The technological skills developed would be directly applicable to medical electronics, communications equipment of all types, computer architecture, automobile electronics, materials technology and a host of other fields.

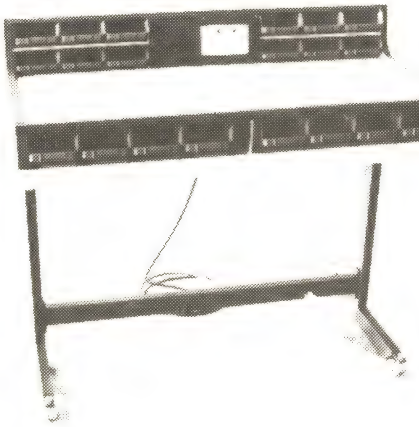
If Australian participation in the project is given the go-ahead, we will have the opportunity to maintain our position at the forefront of astronomical research, and at the same time boost Australia's manufacturing industries into the space age. The benefits in increased industrial expertise and local participation in advanced technological projects could be incalculable. A decision by the Government not to fund the Starlab project could be the death knell for astronomy in Australia.

THE HOBBY DESK DESIGNED FOR THE 80's

FEATURES:

The desk top slides open to provide access to tools, etc, underneath. There are 12 small and 8 medium sized bins within easy reach giving ample storage for many components. A double safety power point is provided on a panel in the centre of the desk. There is room on the panel for additional instrumentation if required. The trolley section is manufactured from heavy gauge tube, finished with hard wearing epoxy enamel and quality castors for easy mobility. This hobby desk makes an attractive pieces of furniture and eliminates the need of "packing up" after a session of hobbying. Simply unplug the lead and wheel away into a spare area.
The unit has been designed to meet the needs of hobbyists in many fields. The desk section comes in various bright coloured laminates, also available in woodgrain finishes.

Jaylam products have designed this great new hobby desk for hobbyists who are not only looking for an excellent working area but also for space saving appeal as well.

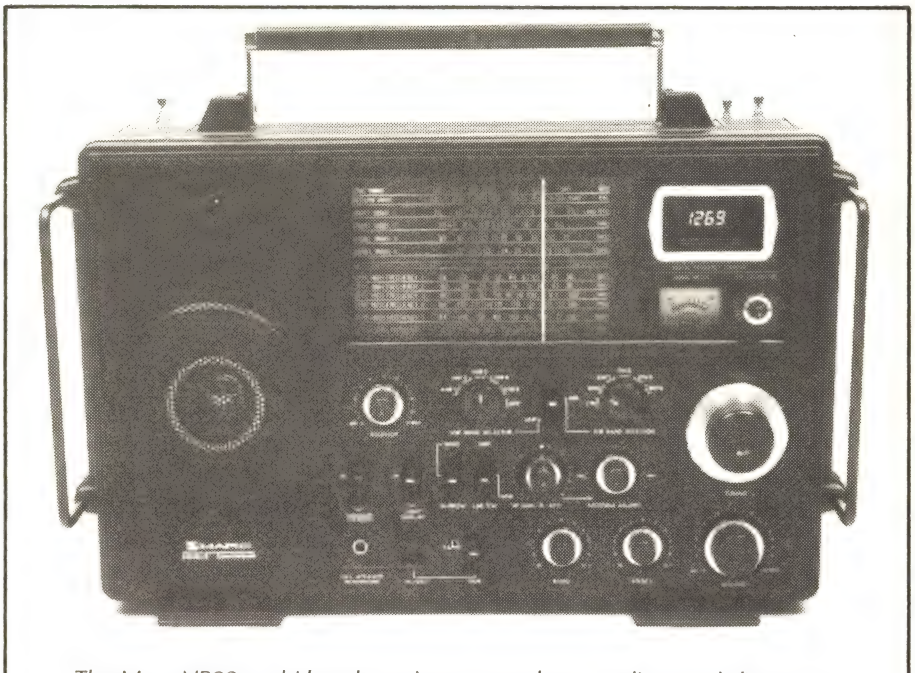


CONTACT:

Jaylam Products Pty Ltd,
31 Nelson Street,
Moorabbin, Vic 3189. Phone (03) 555 7752.

Marc NR82 multi-band superhet receiver

The Marc NR82 is a most unusual receiver with continuous coverage of the medium and high frequency bands up to 30MHz and selected coverage of VHF and UHF bands up to 570MHz. It also has a 5-digit frequency display and generous audio output.



The Marc NR82 multi-band receiver covers low, medium and shortwave bands, as well as providing VHF and UHF reception.

With 12 selectable band segments within the frequency range from 145kHz to 470MHz and provision for tape in or out, this receiver provides the user with a choice of normal broadcast reception, shortwave broadcasts, HF amateur bands, FM broadcast band, VHF and UHF amateur bands plus coverage of several commercial VHF/UHF and low frequency aircraft bands. The tape facility allows recording off air or use as an amplifier for a tape deck.

Physically it is on the large size, with overall diamensions being 484mm (H) × 355mm (W) × 165mm (D). Weight is 5kgs without dry cell batteries fitted.

In appearance it is eyecatching, having overtones of military/commercial design accentuated by the handles at each end. These protect the controls from damage should it be tipped over. However, the unit is very stable standing in an upright position.

Three telescopic antennas, HF, VHF and UHF, plus a ferrite rod antenna for the low frequency bands are provided, together with provision for attaching external VHF and UHF and long wire HF aerials when the receiver is used in a position for serious SWL DX-ing. A recess in the back of the case houses the PL259 socket for the VHF/UHF aerial, terminal screws for wire aerial, antenna change over switch and socket for external 12 volts supply.

A three-way power supply system, with 240V mains, eight D-size cells or external 12V is provided.

The receiver is basically a double-conversion superhetrodyne and uses a 10.245MHz crystal-controlled local oscillator for the VHF and UHF bands. It is capable of receiving amplitude and frequency modulation, upper and lower single sideband, CW (Morse code) and radioteletype. The stability is good even when checked over a period of over two hours on the 430-470MHz band.

All controls are well marked and easily read.

Band switching is simple and positive. Two six-position rotary switch banks allow selection of the desired bands. One selects the low, medium and high frequency segments, the other the VHF segments and UHF band. A flick of a switch allows either bank to be activated.

The band segments are: 145kHz – 360kHz; 525kHz – 1.6MHz; 1.6MHz – 3.8MHz; – 3.8MHz – 9MHz; 9MHz – 22MHz; 22MHz – 30MHz. On the VHF switch the segments are: 30MHz – 50MHz; 68MHz – 86MHz; 88MHz – 108MHz; 108MHz – 136MHz; 144MHz – 176MHz; and UHF 430MHz – 470MHz.

A 165mm × 95mm dial clearly shows the frequency range of each of the 12 band segments plus a logging scale. A vertical cursor, cord driven by a 40mm diameter tuning control knob, allows tuning to approximately the desired frequency. This is supplemented by a digital frequency counter readout with a resolution of 1kHz on LF, MF, and HF bands and 10kHz on the VHF bands. There is no digital readout display on the UHF band, 430MHz – 470MHz.

A signal strength meter (which is not illuminated) is also provided as a tuning aid although its performance as an "S" meter leaves something to be desired. The meter is also used in conjunction with the SW calibrator for accurate readout.

The tuning mechanism is an epicyclic

gear train and has some backlash, allowing small movement of the tuning knob before any frequency change takes place. However, the gear train for the cord driven cursor does not reflect any backlash. There is only one speed tuning rate, which appears to be a compromise so as to accommodate tuning of all bands.

Individual converters are used for each VHF segment and the UHF band and a switched pre-tuned coil system is used for the other band segments.

Apart from the circuit schematic in the user's manual no other technical information was available when writing the review so mixing frequencies and other pertinent information were not known. However, low noise FETs are used in the tuning circuits and sensitivity seems reasonable.

The construction is good, all components being accommodated on one large printed circuit board. Use is made of plug-in leads where necessary. Along with a 12.5cm speaker and antennas, power cords and dry cell batteries are housed in the strong black plastic case. Removal from the case for internal inspection by an inexperienced person is not recommended.

Other controls are: Power on/off switch; Digital display and dial light on/off switch; Squelch, which is effective on all VHF band segments except 108MHz – 136MHz; Wide or narrow band width selector; RF gain and BFO; Antenna adjust; USB – Normal – LSB-CW; Bass and treble tone; Volume; and headphone/extension speaker jack.

Audio quality is quite acceptable for ordinary use and amplifier output is quoted at five watts.

Overall performance on the MF broadcast and VHF FM bands is good. On the HF bands, it is quite lively and gave reasonable satisfaction for broadcast DXing. SSB amateur station signals could also be resolved with a little practice.

On VHF bands other than the FM broadcast segment, tuning is somewhat critical except on continuous or strong signals. It really depends on what the listener wants to hear on these bands, as to how well it is seen to perform. For example you could listen to air traffic control, taxi services, commercial traffic or 144MHz – 148MHz amateur stations. The UHF band has similar activity and tuning is extra critical. Aircraft beacons are to be found on the LF band.

Other points noted were several spurious beat notes on some HF and VHF band segments. Double spotting occurred on VHF band segment five with 144MHz – 148MHz signals appearing approximately 21MHz higher, probably due to mixing with a harmonic of an intermediate frequency.

There was some breakthough of broadcast station signals into adjacent LF and HF band segments. This was also present at low levels on the FM broadcast band when in close proximity to a strong FM station.

Hash from the digital frequency counter appears on some VHF segments but can be eliminated by turning the display switch off, after you have tuned the set.

Information in the "Handling Manual" is sparse and barely sufficient to acquaint an inexperienced person with the operating procedures. The "foreign" English text could also confuse non or semi-technical readers.

Although the NR82's sensitivity, stability and audio quality have been favourably commented upon, it cannot be classed as a communication or specialised broadcast receiver.

Having said that, I should commend the Marc NR82 as an unusually versatile receiver. Considering its relatively straightforward circuitry, it does perform surprisingly well, particularly in regard to stability. For the listener who wants to cover all these bands with just one receiver, it is probably the only choice. And at $349 including sales tax, it would appear to be quite reasonably priced.

The Marc NR82 is available from Jaycar Pty Ltd, 125 York St, Sydney NSW 2000 and from Altronics, 105 Stirling St, Perth, WA 6000 (PJH).

AN INTRODUCTION TO DIGITAL ELECTRONICS

Here are the chapter headings:

1. Signals, circuits and logic
2. Basic logic elements
3. Logic circuit "families"
4. Logic convention and laws
5. Logic design: theory
6. Logic design: practice
7. Numbers, data & codes
8. The flipflop family
9. Flipflops in registers
10. Flipflops in counters
11. Encoding and decoding
12. Basic readout devices
13. Multiplexing
14. Binary arithmetic
15. Arithmetic circuits
16. Timing & Control
17. Memory: RAMs
18. ROMs & PROMs
19. CCD's & magnetic bubbles
20. D-to-A converters
21. A-to-D converters

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $4.50** OR by mail order from "Electronics Australia", PO Box 163, Chippendale 2008. **PRICE $5.40.**

AMS MAIL ORDER CENTRE

TAPES CHEAP!

BULK TAPES DISCOUNTED

TDK

SA-X C90	SUPER AVILYN DUAL COATING	10 for $49
SA C90	SUPER AVILYN	10 for $39
AD C90	ACOUSTIC DYNAMIC	10 for $30
D C90	DYNAMIC	10 for $24

maxell

UDXL IIS C90	EPITAXIAL	12 for $58
UDXL II C90	EPITAXIAL	12 for $49
UDC 90	ULTRA DYNAMIC	12 for $38
LN C90	LOW NOISE	12 for $28

BASF

CrO_2 C90	CHROMDIOXIDE	10 for $48
FE C90	FERROCHROME	10 for $38
LH C90	LOW NOISE	10 for $25

VIDEO — OPEN REEL — METAL

MAXELL, TDK, BASF, AKAI

SEND FOR COMPLETE TAPE PRICE LISTS — FREE

HI-FI SYSTEMS

AMPLIFIERS, TUNERS, TAPE DECKS, TURNTABLES, SPEAKERS, HEADPHONES, RECEIVERS

OUR RANGE INCLUDES:

Sansui PIONEER marantz AKAI SOUND DYNAMICS KSW

CAR SOUND

RECEIVERS, TAPE PLAYERS, BOOSTERS, EQUALISERS, SPEAKERS — INCLUDING

PIONEER VOXSON

ACCESSORIES

CARTRIDGES, STYLII, CLEANERS, DEMAGNETISERS, DISCWASHER

eei PARABOLIC STYLUS — COMPLETE RANGE

ortofon MOVING COIL AND MAGNETIC CARTRIDGES

RING OR WRITE FOR FREE PRICE LISTS!

TAPE ORDERS:

ADD: PACK AND POST $3.00 PER ORDER AND SEND CHEQUE/MONEY ORDER TO:

AMS

MAIL ORDER CENTRE,
135 HAWTHORN ROAD,
CAULFIELD, VIC 3162
(03) 528 1149

STOCK AT PRICES SHOWN AVAILABLE AT TIME OF GOING TO PRESS

FORUM

Conducted by Neville Williams

Service Manuals: The latest in banned books!

If correspondence and conversations over the past few weeks are to be taken as a guide, the proverbial "can of worms" has nothing on the overall situation in Australia in relation to electronic servicing, service data and spare parts. One layer down from the industry's formal exterior lies a turmoil of conflict and confusion.

As you may remember, a correspondent triggered the most recent discussion by a letter, published in the February issue, lamenting the unfortunate position of country servicemen: they are faced, he said, with high technology consumer equipment but cut off from ready access to service data and spare parts.

His lament was supported by further correspondence, published in May. This, in turn, drew more readers into the discussion, as will be evident from what appeared in these columns last month.

However, it has become plainly apparent (if one can invoke another simile) that the situation involving country servicemen is the mere tip of the iceberg. A whole lot of servicemen and would-be servicemen, nationwide, are very unhappy about the scarcity of back-up information and spare parts.

Let's stand back a bit and spell out what we are talking about.

BASIC OBLIGATION

It is accepted in Australia that companies which manufacture, import and/or sell goods must support those goods in accordance with any warranties, claims or undertakings applicable at the time.

Moreover, and irrespective of warranties, etc, the purchaser has legal rights. In summary, these add up to the requirement that new goods must be in a saleable condition, be capable of serving the purpose for which they are sold, and must remain serviceable for what can be shown in court to be a reasonable period of time.

To give effect to the above, the vendor obviously has to be in a position to have faulty goods repaired to new condition, or replaced, or else to make restitution by refund of the purchase price.

The laws relating to vendor/purchaser obligations are vastly more complex than any such summary, of course, and the processes of law can be even more so. But reputable companies do try to observe such obligations, not just as a legal requirement, but in order to retain customer goodwill and a good reputation in the marketplace.

For the reasons which we went into last month, imported, high technology electronic equipment presents special problems, such that the supply lines for back-up information, spare parts and expertise are stretched pretty thin, at times, between the local supplier and the manufacturer overseas.

Indeed, I have talked enough with service managers in the major distributors to have sensed the problems that even their in-house service personnel have in coping with new techniques and new models. And a possible language barrier doesn't make it any easier, as I know at first hand.

After that, local suppliers face the task of disseminating the information to brand-identified service centres throughout Australia, with independent service organisations further back in the queue.

As for lone servicemen in the "sticks" or individual purchasers who would like to do their own repairs . . . No wonder they have problems in getting what they need!

That brings me to the seat of much of the present emotion, as reflected in correspondence and comment.

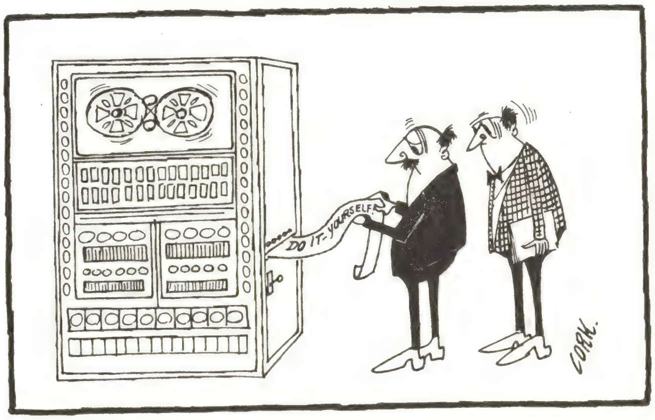
Many correspondents seem to take it for granted that they have an automatic and legal right to service information and spare parts, whether as independent servicemen or as private purchasers aspiring to carry out their own repairs.

ANIMOSITY FOLLOWS

Proceeding from that assumption, they go on to build a huge grudge case against any non-conforming supplier, attributing to them nefarious motives and supporting their case with lashings of emotion and homespun logic.

I know how they feel and, if I had any doubts on that score, they would have been dispelled by a further across-the-table talk with my friend X.Y., whose views were put forward in the last issue. Nor am I forgetting our former editor, Jim Rowe, who took up the cause of the owner/repairer at a first-hand level (see May '82, page 25, col 2).

But, having thought it through and talked it through with someone who should know, I am forced to the conclusion that there is no proven legal basis for deman-



"It's got a small fault and I simply asked it to print out the name and address of that service company!"

ding that a vendor make available service data and/or spare parts to anyone who orders them.

As I have already indicated, a supplier has obligations in regard to the quality of new goods, and to see that the goods can be maintained in a serviceable condition for a reasonable period. How the back-up service is provided is for the supplier to say — as long as provision is made which can be shown in court to be reasonable.

In discussing the matter with various acquaintances, I came up against this retort:

"What's all the fuss? What's so special about the electronics industry?

"If you run into trouble with a washing machine or a refrigerator, you ring the manufacturer and they send out their own service truck. If you decide to 'have a go' yourself, you might get the parts, if you're lucky. But if you try to buy a manual, no way, mate!"

From another acquaintance:

"The thing that's different about the electronics industry is its long-standing tradition of self-employed servicemen and one-time accessable circuits. That tradition started to die years ago and it just doesn't fit the situation any longer!"

Earlier, and in the May issue, I referred to the experience of our then editor Jim Rowe, who received no encouragement at all from the NSW Department of Consumer Affairs and the NSW office of the Trade Practices Commission. There was certainly no support for any legal basis for intervention.

AN ACTUAL CASE

It so happens that, amongst the letters I received, was one from a reader who had been through a similar exercise. The correspondence is too long to reproduce in full but the substance has been retained.

On October 28, 1980, the correspondent wrote to the then Minister for Consumer Affairs in NSW, Mr S. Einfeld, MLA, in the following terms (abbreviated).

Dear Sir,

I wish to complain and invite your opinion on a disturbing trend by distributors of consumer electronics equipment to restrict availability of service information.

As I have completed the Electronics and Communications Certificate Course, at a technical college, I feel qualified to work on my own consumer products.

Distributors refuse to make service manuals available to anyone other than "Affiliated Service Organisations".

This, I feel, will have more serious consequences than merely affecting people in my situation. It means all consumers are faced with a restrictive trade situation, where distributors will handle all servicing of their own products, thereby enabling them to control servicing prices and even redundancy.

My inquiries have found that, in the United States, such information must be provided by law.

I have found this to be of growing concern amongst my colleagues.

C.B. (Balgowlah, NSW)

In early November, the Minister replied as follows (abbreviated):

Dear Mr B,

I can appreciate that this is a matter of concern to you, given your expertise in this area of servicing. In my mind, it is an unreasonable situation, as I believe that consumers should be given the opportunity of effecting their own repairs if they are qualified to do so.

Whilst any issue relating to restrictive trade is a matter more appropriate to the Federal Government's Restrictive Trade Practices Commission, I shall discuss your letter with the Commissioner for Consumer Affairs to see whether or not my Department can help in any way.

Sydney D. Einfeld,
(Minister for Consumer Affairs).

A SECOND LETTER

In mid-January of '81, the Minister wrote a second letter on the same subject (abbreviated):

Dear Mr B,

The Commissioner for Consumer Affairs has informed me that his officers sought advice from the Sydney Regional Director of the Trade Practices Commission, who reported that the Commission had received legal advice to the effect that the practice in question is not in breach of the provisions of the Trade Practices Act relating to exclusive dealing. Should you require any further information about the legal position, I suggest you contact the Commission direct.

I am concerned, nevertheless, that this practice may disadvantage consumers and I intend to refer the matter to the Consumer Affairs Council, an advisory body whose membership is representative of both consumers and those experienced in trade and commerce for further research. I will ask the Council to report to me on any action that may be desirable in the interests of consumers, having regard to existing practices in Australia and overseas.

Sydney D. Einfeld,
(Minister for Consumer Affairs).

Not to be daunted, J.B. made specific inquiries and listed for the Department a dozen or so electronics companies, of which only four were able or prepared to supply service data, presumably to other than affiliated service organisations.

He also had interviews with Consumer Affairs staff who were helpful but not

ELECTROCRAFT

Hills TELEBEAM

Y10/6-11

- **High gain wide band covers all of Band 111 channels.**
- **Good front-to-back ratio minimises ghosting problems.**
- **Efficient matching for maximum transfer into downlead.**

Model	Aust Channel	Gain (dB)	F/B Ratio (dB)	Price
Y4/6-11	6-11	5-6	14-15	$19.86
Y6/6-11	6-11	6-8	15-17	$23.09
Y10/6-11	6-11	8-10.5	20-26	$36.24
Y14/6-11	6-11	9-12.5	22-26	$44.28

CH's

203/345A	5EL	$33.36
207/345A	7EL	$51.63
103/0-2	3EL	$35.07
205/0-2	5EL	$61.46
Y/3M	3EL	$28.00
FM/AM Whip (car radio)	1550mm	$19.95

Use one of the "Y" series antenna's with the latest Mast Head amplifer MH.6 from Hills, which has the highest gain & lowest noise figure of any mast head amp: made in the country (36dB Gain) (Noise figure 2.5dB) & it will increase your signal level by a ratio of 63 times.

Diplexers. High-Low Band 75Ω in weatherproof housing with saddle clamp to fit to mast.
Price: $15.26.

High-Low 300Ω as above $9.17

Baluns antenna type.
"Y" series fits in housing assembly $3.60
OSAB completely weatherproof & corrosion free $4.86
Set Balun BT.2 $2.02
75Ω to 75Ω 2 metre fly lead $1.99
For literature please enclose 27¢ postage.

FREE VERBAL ADVICE GIVEN. WE CANNOT ENTER INTO CORRESPONDENCE.
INTERSTATE ORDERS — BANK CHEQUE OR MONEY ORDER ONLY.

ELECTROCRAFT
68 Whiting Street, Artarmon,
NSW 2064. PO Box 398.
Phone (02) 438-4308 ext 6.
Hours: Mon-Fri. 8am to 5pm.

BIG SAVINGS for NZ hobbyists

Compare Dick Smith's prices to those you've been forced to pay in the past... And don't forget, we'll send any item anywhere in New Zealand from our Auckland Mail Order Centre.

YOU DON'T HAVE TO PAY THE EARTH FOR QUALITY TOOLS!

SAVE $5!

OUR BIGGEST SELLING Meter

We've sold thousands of these to students, amateurs, hobbyists, technicians ... even repairmen! If you're into electronics as a hobby or as a business, and want a reliable economical multimeter this has got to be the one! Robust, high sensitivity, very easy to use. Comes complete with batteries, test leads and instructions. Cat Q-1024.

- 24 ranges
- 20,000 ohms per volt
- Diode protected movement

ONLY $NZ 29 95

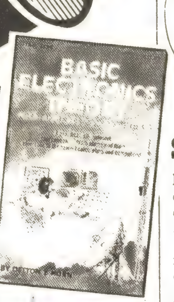
WAS ~~$35.00~~
UNTIL SOLD OUT!

TOWERS' INT. TRANS. SELEC.

If you deal with transistors — whether as a student, hobbyist, buyer etc, — this book can help you. It offers information on ratings, characteristics, terminal identification and substitution equiv. and more. Cat B-1826

NEW EDITION!

ONLY $NZ 27 90



BASIC ELECTRONICS THEORY with projects & experiments

Want to learn about electronics? Then this is the book for you. It is an introductory text (with experiments) of basic electronics theory. Also, it is a convenient reference manual, with almost any piece of information readily accessible. Cat B-1615

A MUST! ONLY $NZ 17 50

HORN SPEAKER

Here's a horn ideal for all PA work, burglar alarms, in fact any outside work because of its weatherproof nature. It has an impedance of 8 ohms and a power rating of 5 watts. It has a mounting bracket for easy installation and comes complete with lead. Cat C-2705

only $NZ 19 95

Look after your deck!

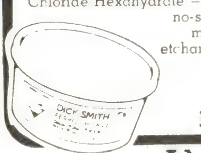
TAPE HEAD DE-MAG.

Improve the sound quality and protect your recordings with this tape head demagnetizer. Ideal for all audio tape decks (NOT video recorders) it simply plugs into 240V AC mains, and is held near the head, then drawn away slowly. Full instructions are supplied. Cat C-7222

and only $NZ 14 95

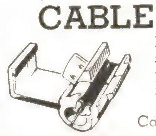
Why pay more? Ferric Chloride

Now supplied as beads of Ferric Chloride Hexahydrate — the no-mess, no-spill way. 250g makes 1 litre of etchant. Cat H-5652



only $NZ 2 95

AMAZING CABLE JOINERS



Now you don't have to spend hours trying to join wires. These snaps make it so easy!

Cat H-6720 **only 85¢ NZ**

HOLE PUNCH SET

An absolute necessity for anyone who needs a large hole cut through metal. Very easy to use, needs no filing and will cut a hole without distortion. Comes with five punches (16, 18, 20, 25 & 30mm) and will handle steel up to 22 gauge and aluminium up to 16 gauge. Excellent value!

Cat T-4900 **ONLY $NZ 15 90**

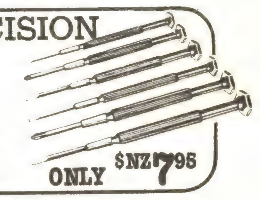
1,000's SOLD!

MINI PC DRILL

Help make work on PCB's, jewellry, model making, etc, child's play! This mini PC Drill is extremely easy to use as the on/off switch is in a very convenient position. Excellent output, and no trailing power cords as it runs off 2 'c' cells. Cat T-4750

EXCELLENT VALUE AT
ONLY $NZ 29 95

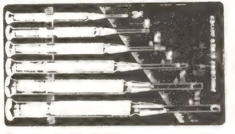
6 PIECE PRECISION DRIVER SET



Very handy to have around! Quality screwdrivers at a low, low price! Chrome plated, they are presented in a plastic storage case and consist of 4 blade drivers from 1.4mm to 2.9mm, and 2 Philips drivers, No's 0 and 1. Cat T-4360

ONLY $NZ 7 95

6 PIECE JEWELLERS DRIVER SET

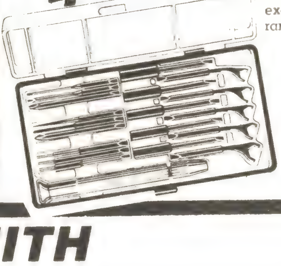


Beautifully made screwdrivers, chrome plated body with a free running knob on top. Blades are the finest quality nickel chrome molybdenum steel, precision ground. Presented in a handy transparent moulded case. Sizes range from 0.8mm to 3.8mm. Cat T-4350

EXCELLENT VALUE! ONLY $NZ 6 95

EVERY HOBBYIST SHOULD HAVE ONE!

AMAZING 20 PIECE METRIC UTILITY SET



Great value for money! 20 pce nickel chrome molybdenum steel with chrome plated handle in a handy transparent plastic box. Blade and Philips drivers, Allen keys, spanners and more. You will be proud to have this excellent quality set in your tool range! Cat T-4365.

Great value at $NZ 14 95

PROTECT YOUR LIFE & EQUIPMENT

This fantastic kit electronically detects earth fault currents and trips a relay which immediately cuts the power. The relay cannot be reset until the fault has been corrected. Designed to run 240V AC the unit is portable and built into a tough molded plastic case. K-3315.

Core Balance Relay

only $NZ 74 50

The smart way to buy your resistors and capacitors:

1) Resistor pack: 300 computer selected ¼w types. Cat R-7010 ... only $NZ7.50
2) Metal films: 300 precision 1% ¼w metal film resistors. Cat R-7015 only $NZ15.00
3) Greencap packs: 60 greencaps Cat R-7040 .... only $NZ8.50
4) Electrolytic pack: 55 electros Cat R-7030 only $NZ8.50
5) Ceramic pack: Over 60 ceramics Cat R-7050 .... only $NZ5.50

Build this Timer/ Stopwatch

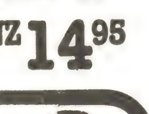
Use as a stopwatch, countdown timer or event timer. Large LED and selectable timing rates between 0.01 and 1.0 secs. Cat K-3435

IDEAL FOR SPORTING EVENTS, DARKROOM TIMER, ETC!

only $NZ 59 50

DICK SMITH Electronics

98 Carlton Gore Rd, Newmarket
Auckland. Tel (649) 50 4409
Mail Orders: PO Box 9452 Newmarket NZ
Store Hours: Mon-Fri 8.30am to 5pm



DSE/A310/PAI

able to give to a specialised individual complaint the same attention as to a more "popular" area. Nevertheless he reports:

"One of their actions was to send questionaires to all companies to obtain their opinions and attitudes to the supply of service information and parts.

"The majority of such companies refused to reply or gave a negative response.

"A disturbing aspect of this problem is that refusal to supply information is now extending beyond sophisticated video recorders, etc, to the more mundane TV and radio cassette area."

And that is apparently where C.B.'s efforts bogged down on the basis that, while suppliers must provide or nominate a reasonable servicing resource, they are free to structure it how they please. It may or may not include direct provision for independent servicemen or owner/repairers.

AT COMPANY LEVEL

Lest this seem to be a recital of a big company/small man situation, it obviously applies at other levels in much the same way.

During the month, I had a call from a director of a high technology enterprise who was getting all set (mentally, at least) to take on a major overseas supplier. Whether he can find firm enough grounds on which to proceed is another matter.

In a follow-up letter, he explained that his company is interested in supplying a high technology system to an educational institution. As part of the system, they want to use a certain kind of module (I am required to be non-specific because of the delicacy of the situation). The problem is that the suppliers of the particular module will not release the relevant service manual, insisting rather that the responsibility for maintenance is theirs and theirs alone, under one or other formal (and allegedly expensive) service contract.

The frustrating thing, says the Director, is that the customer, in a case like this, may have the desire and on-the-spot expertise to correct routine malfunctions — with the prime contractor as the next resource. But both are being denied access to a key manual.

Closer to home, the same company has a piece of communications equipment in daily use which, while fairly reliable, does suffer the occasional minor fault. But while there is ample resident expertise to deal with such faults, their request for a manual or a circuit diagram "has been fobbed off with various excuses".

Which brings me to words of wisdom which emanated from two distinct sources, during discussion of this general subject. One piece of advice had to do with the world of computers, printers, modems and other such gadgetry:

"The smart thing to do is to make the supply of a manual or a circuit a condition of sale, when you have some real leverage over the vendor. It may cost a few extra dollars but it could easily save you more than that further down the track.

The other was in much the same terms but relating to consumer electronic products. The advice could be particularly valuable for people in country areas, who may have to rely on independent servicemen. If you're going to be able to get a manual or a circuit for a TV set or a whatnot, it will be when the set is new — not when it has been superseded and the literature is out of print.

And, when you do get it, seal it into a stout envelope, mark it prominently and tape it to the equipment; or put it somewhere where it won't be discarded with surplus papers.

There's nothing quite so easy to lose as something you particularly meant to keep!

As seen from the other side . . .

Since writing the foregoing material, I have spent a week in Japan with fellow editors and a group of audio/video dealers, as guests of Matsushita Electric. While I was not able to pursue the problems of servicing officially or in detail, one message came through loud and clear:

Neither distributors nor dealers are primarily interested in "cornering" service work for themselves; some, in fact, do not have their own service departments.

Their prime concern is to ensure that, as far as possible, service is done by people with the appropriate training and facilities. Breakdowns are problem enough, they say, without the risk of someone making matters worse by unskilled tampering or time-wasting speculation, for which the customer has to pay.

One company executive agreed that there were two sides to the question but, on balance, he much preferred his company's policy of approved service centres, wherever possible.

UV LIGHT BOX
- 4 × 20" UV Tubes
- Electronic Timer
- Sliding Tray
- Safety Micro-switch $295.00 (+S.T.)

DEVELOP/ETCH TANK
- Rigid PVC
- Heater
- Standard Hose Fittings
- 24" Wide 12" High $195.00 (+S.T.) 2 Compartment $285.00 (+S.T.) 3 Compartment

IDEAL 'IN HOUSE' EQUIPMENT FOR USERS OF:
- RISTON 3000 or other Printed Circuit Board
- 3M Scotchcal
- 3M Image 'N Transfer
- Electroplating

DISTRIBUTOR ENQUIRIES WELCOMED

KALEX
101 Burgundy St,
Heidelberg 3084
(03) 458 2976
Telex AA 37678
MELTON
(03) 743 1011

ELECTRONIC COMPONENTS & ACCESSORIES

● SPECIALIST SCHOOL SUPPLIERS ●

SAVE A FORTUNE: BUILD IT YOURSELF FROM A DICK SMITH KIT!

Why pay for commercial equipment when, with just a few hours of your time, you can build it yourself with the aid of a Dick Smith kit. Because you supply the labour, you can save $$$! AND what's more, it's great fun. So have a go and do it yourself. Your friends will never believe you built it!

Building a Dick Smith Kit is as easy as A B C!

A

Everything you need is supplied — parts, solder, even nuts and bolts. AND most kits include detailed instruction manuals, making construction a breeze!

B

It goes together so easily; you don't have to be an expert to build a kit, just follow the instructions.

C

And it's finished! Sit back and enjoy your project: because you did it yourself!

And it looks so good your friends won't believe you built it!

SAVE $$$

DUAL TRACE CRO SWITCH

SAVE MONEY and convert your single trace CRO to a dualtrace with this superb kit. Dual trace CRO's have uses in almost every application. Whenever you need to compare two waveforms, the dual trace CRO is the best bet. Cat K-3065 SEE EA FEB 81

only $49.00
WAS ~~$55.00~~!

TV CRO ADAPTOR

Want to save a heap of money? If your electronic enthusiasm is hindered by financial burdens, this could be the kit for you. The TV CRO converts any standard TV set into a large screen oscilloscope with a frequency response from 10Hz to 300kHz with a sensitivity of 100 mV RMS for full screen deflection. Cat K-3060. SEE EA MAY 80.

only $29.95

UNIVERSAL TIME/ STOPWATCH

This terrific all-purpose counter can be used as a stopwatch, countdown timer or event timer. Large LED display, and timing rates are switch selectable between 0.01 secs to 1 sec. Great for sporting events, darkrooms - in fact anywhere you need to keep track of the time. Cat K-3435.
SEE EA SEPT. 81

only $39.50

SPECIAL

240V CONTROL TIMER

Switch an appliance on for a preset period any time of night or day. Large lighted LCD clock and tough die cast case combine to give rugged reliability. Far more accurate than time switches enables time on period to be switched to 16, 32, 64 & 128 minutes. Cat K-3085.
SEE EA APRIL 80

only $42.50 **WAS ~~$49.00~~**

SPECIAL

TRANSISTOR ASSISTED IGNITION

This kit incorporates circuitry with dwell extension which results in a hotter spark at high engine speeds and is compatible with modem electronic tachometers. All components and casing are supplied Cat K-3300.
SEE EA NOVEMBER 79

only $29.00
was ~~$34.00~~

CAPACITOR DISCHARGE IGNITION

OVER 15000 SOLD!

This has got to be the best value CDI available. Your car will be easier to start ... when cold or hot, your plugs will last longer keeping your car in tune and using less petrol Cat K-3280

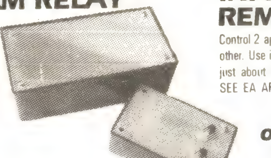
only ~~$33.50~~ $29.50

SEE EA JULY 75

SPECIAL

INFRARED LIGHT BEAM RELAY

Protect your property and equipment with this ideal burglar alarm. A light beam trigger that uses an invisible beam of light! It has a range of 5m and there are no lenses to adjust. Battery power gives the unit about 50 hours continuous use. Cat K-3380.
SEE ETI MAY 81

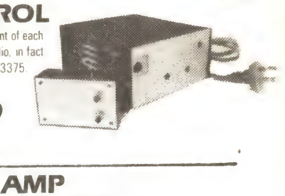


only $59.00
was ~~$65.95~~

SAVE $$$

INFRARED 2-CHANNEL REMOTE CONTROL

Control 2 appliances simultaneously, independent of each other. Use it to control your alarms, stereo, radio, in fact just about anything you can think of. Cat K-3375.
SEE EA APRIL 81

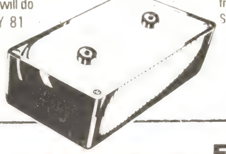


only $29.50
WAS ~~$38.50~~

SAVE $$$

UHF/VHF DOWN CONVERTER

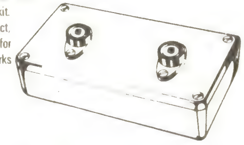
SINGLE CHANNEL ONLY. This project will convert TV station transmissions in the UHF band down to unoccupied channels in the VHF TV band. Why spend money on expensive TV sets fitted with UHF when this kit will do the job just as well. Cat K-3235 SEE EA MAY 81



$29.50
WAS ~~$33.50~~

TV MASTHEAD AMP

Improve your TV reception with this easy to build kit. Can cut out 'snow' effect, reduce 'ghosting' effect, good for picking up distant stations and can be used for boosting FM signal as well, plus lots more! Works from 240v supply included. Cat K-3232
SEE EA AUGUST 79



only $33.50

SAVE $$$

DIGITAL FREQUENCY COUNTER

The case shown here is an option

Now a completely new frequency and period counter using the latest IC technology. Low component count makes it very easy to build and very reliable It rivals the performance of commercial units costing many times the price Cat K-3439
SEE EA DEC 81

only $99.50

FUNCTION GENERATOR

This kit produces sine/triangle and square waves over a frequency range from below 20Hz to over 160KHz! It has four digit LED readout enabling accurate frequency settings. The kit makes an ideal companion to our Frequency Counter Kit (Cat K-3439). The case shown here is an option (Cat H-2505 $19.95) Cat K-3520.

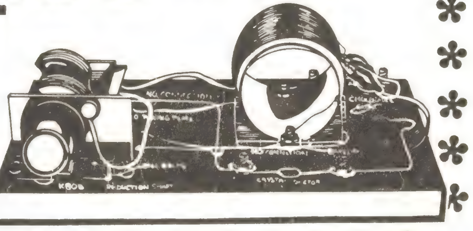
only $52.50
WAS ~~$59.50~~

SEE EA APRIL 82

* * * * * * * * * * * * * * * * * * *

DICK'S ORIGINAL 1952 CRYSTAL SET

Want a radio that works during blackouts and doesn't need batteries? Then this is just for you! Dick's own crystal set kit. A satisfying project that will give you lots of fun. It can pull in a surprising number of broadcast stations and produce good sound even when connected to a stereo system. All necessary parts are supplied. Cat K-2650.
SEE EA APRIL 82

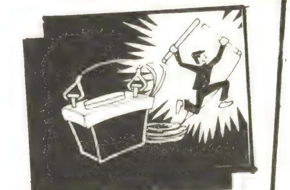


only $6.90

* * * * * * * * * * * * * * * * * * *

NEW KITS ... STOP PRESS ... NEW KITS ... STO

ONLY $37^50

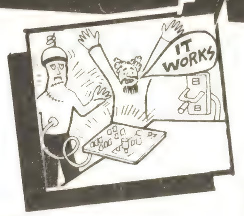


12V FLUORO INVERTER

Handy project which should have appeal, with our impending power strikes. 12V operated inverter circuit in our CDI metal case! Also the power to drive 2 x 20watt or 1 x 40watt fluorescent tube (tube or container not supplied). Efficient circuit gives low current drain.

Cat K-3275

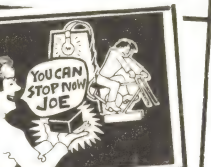
ONLY $65^00



PROTOTYPER

Invaluable for Designers Experimenters, Hobbyists, useful for school projects, great as a teaching aid - Includes: Oscillator, led drivers, switches, debounce circuit all on-board. This safe unit has a seperate power supply. The power supply can be varied or fixed. 5V and 1.25V to 10V. It has easy connector strip - every workshop should have one.
Cat.K-3465

ONLY $79^00

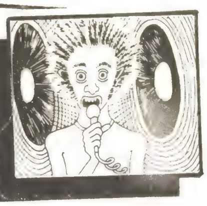

YOU CAN STOP NOW JOE

POWER SUPPLY

This very useful Power Supply Kit is designed for use with high powered transceivers or where several small C.B.'s have to run from the one supply. Output voltage is 13.8 volts (fully regulated) at 7.5 amps continuous or 10 amps peaks. The supply is housed in a sturdy case, overload protector being provided by a Darlington Pair (current limiting) with led overload condition indication.

Cat K-3452

ONLY $119



150watt PA AMPLIFIER

This fabulous little PA kit allows you to let more people hear you at your Rallys or if you're in to bigger things like Fete's we would all agree that this kit would save you heaps. It features: 2 mic inputs, 1 aux input, also Pre-amp out and insert fascilities - when used with OP590 output transformer the applications are limitless. e.g. 2ohm, 4ohm, 8ohm, 16ohm, 50ohm (70v), or 100ohm (100v). Cat.K-3525. Transformer to suit MO153.

Short form no case supplied.

LCD DIGITAL PANEL METER

ONLY $29^50

A versatile highly accurate panel meter using a large liquid crystal display for low power consumption. The PC board design allows for maximum flexibility to cater for varied mounting arrangements. The low cost makes it ideally suited as a readout device on many projects, at both amateur and professional level. It may be considered as a viable replacement to conventional existing analogue equipment.
Cat. K-3450

Short form no case supplied.

PRICE SLASH PLUS A BONUS

Due to overordering we now have an excess of PCB's! So why not buy now while we're offering them at these ridiculously low prices. **You reap the benefit!** PLUS All boards bought after the 1st of August will include a copy of the EA or ETI article relating to that particular PCB.

Cat No.	*Kit*	*Price*			
H-8330	Radar alarm	99¢	H-8404	Electrotune	$6.75
H-8340	Morse key	$1.20	H-8420	Voice canceller	$1.80
H-8366	Metal locator	$1.10	H-8421	Voice operated relay	$1.50
H-8377	Power chopper	$1.00			
H-8384	Selectalot	$1.50	H-8613	Car alarm	$1.30
H-8387	Cylon voice	$1.20	H-8638	Uni relay driver	$1.40
H-8395	Infra red TR/REC	$1.90	H-8634	Neg. ion generator	$3.50
H-8397	Infra red control	$2.90			

SPECIAL PARTS:

Ultrasonic transducers as used in the EA Electronic Rule kit. Cat No's L-7050 & L-7052 ... **ONLY $4.95**
Panel meter moving iron as used in EA Mains Watt Meter Kit. Cat No. Q-2090 ..... **ONLY $7.95**

Parts for New Kits

Special parts for kits which are not in our current catalogue (or may be hard to find!)

CORE BALANCE RELAY – SEE ETI APRIL 81 (CAT K-3315)

PL24/5VA Transformer	Cat M-3590	$8.95

SUPER 80 COMPUTER -SEE EA AUG 81 (Cat K-3600)

20k 10 turn trimpot	Cat R-1970	$2.60
Mini 5 volt relay	Cat S-7105	$2.60
12MHz crystal	Cat K-6035	$3.50
2716 EPROM	Cat Z9207	$12.50
S-100 Edge Connector	Cat P-2670	$9.75

DIGITAL FREQUENCY COUNTER - See EA Dec 81 (Cat K-3493)

Deluxe instrument case	Cat H-2505	$19.95
(above case is also used in function generator & new car computer)		
10MHz crystal	Cat K-6032	$4.95

FUNCTION GENERATOR - See EA April 82 (Cat K-3520)

FND500 LED displays	Cat Z-4150	$1.35
XR2206 IC	Cat Z-6820	$6.95
Slide Switch – 3 pole 3 position	Cat S-2070	95c
Slide Switch – 2 pole 3 position	Cat S-2030	80c
Slide Switch – 2 pole 2 position	Cat S-2040	65c

150W MOSFET AMPLIFIER - See ETI May 82 (Cat K-3525)

2SK134 FET	Cat Z1815	$7.90
2SJ49 FET	Cat Z-1816	$7.90
PCB	Cat H-8644	$6.50
(PCB for mosfet amp preamplifier)	Cat H-8646	$6.50
NE5534 IC	Cat Z6090	$4.50

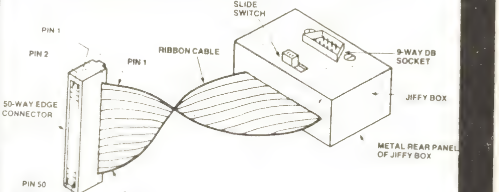
SYSTEM-80 JOYSTICK ADAPTER KIT

Ever wish you could hook up a joystick to your System-80, so you could play games faster and with greater realism? Well, your wish has been answered. This little adapter won't strain your piggy bank and can be assembled very easily. It plugs in, and away you go!

NOTE: Compatible with most U.S. games software designed to work with the "Alpha" joystick.

Cat. K-3455

Joystick adaptor Kit $37.50

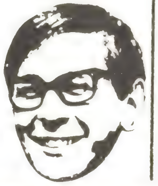


MATCHING JOYSTICK

This is the joystick to go with the above adapter. Standard Atari-type joystick, with sensors for four primary directions of motion and separate "fire" button. Complete with cable and DB-09 connector. (Also suit VIC-20 computer).

Cat. X-2020 .... $19.90

DICK SMITH ELECTRONICS

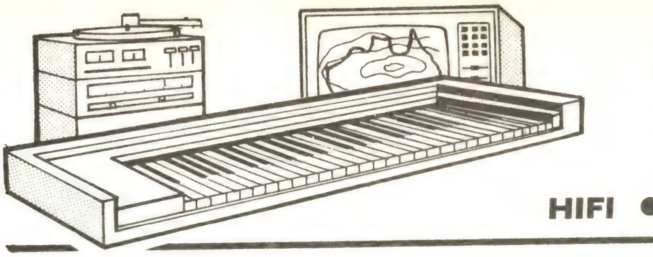


SEE PAGE 124 FOR ADDRESSDETAILS

ASK FOR YOUR FREE COPY OF OUR ALL NEW KIT CATALOGUE!

DICK SMITH Quality Kits

DSE/A306/PAI.Fi.



Audio-video Electronics

HIFI • HOME VIDEO • PROFESSIONAL AUDIO

Australian synthesiser cracks the world market

In a complete reversal of normal Japanese-Australian audio trading, the giant Matsushita Electric Company (National Panasonic and Technics) has signed a marketing agreement involving an Australian-designed and manufactured music synthesiser system — the CMI or Computer Musical Instrument.

by NEVILLE WILLIAMS

The CMI is manufactured by Fairlight Instruments Pty Ltd, with headquarters at 15 Boundary St, Rushcutters Bay, NSW. It is already being marketed in Australia, USA, Germany, France and England, and the contract signed with Matsushita, said to be worth an initial $250,000, will put the instrument officially into Japan. In the longer term, it could mean that the CMI will be produced in that country by Matsushita, under licence to Fairlight Instruments.

While, to some readers, the name Fairlight and the initials CMI will be unfamiliar, both are getting to be very well known indeed in world musical circles.

A CMI user list of performers/composers/groups in the UK names seven prominent entertainers including people like John Paul Jones, Peter Gabriel and Mike Oldfield, and groups like "Led Zeppelin", "Pink Floyd" and "Genesis". There is Jean Michel Jarr in France, "Kraftwerk" and six other user/composers in Germany, Austria and Switzerland, "Fleetwood Mac", "Bee Gee's" and others in USA and, of course, further user/composers in Australia.

A string of studios around the world are included together with university music departments in UK, Canada, USA and Australia. Even the famous Dr Robert Moog, probably the best known name in the world of music synthesisers, has his own CMI.

While the Fairlight CMI is a musical instrument as modern as they come, its roots actually go back some 20 years to a period when there was a lot of local interest in the production of electronic musical instruments. At a do-it-yourself level, we were preoccupied with electronic organs.

A regular visitor to our office was a young sales engineer from the then Ducon organisation, by the name of Anthony Furse. Tony, too, was interested in electronic music but he spurned our concentration on oscillators, filters and what passed for organ voices. He dreamed only of "instruments" that could make musical sounds to order — unique musical sounds, with variable pitch, variable harmonic content, variable attack, variable decay, variable everything . . .

What one would do with such sounds he wasn't sure. Nor were we, at the time!

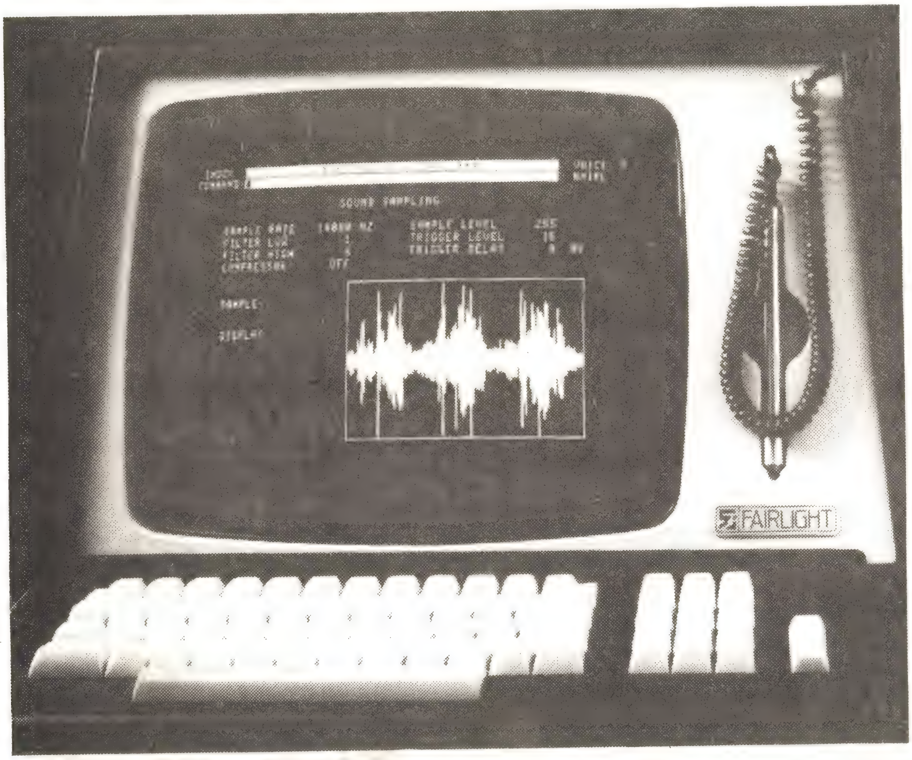
PERSERVERED

But Tony carried right on, giving us little lectures about diode matrixes and such like and his readiness to use as many transistors as might be necessary to achieve the desired end result.

Then he transferred to Fairchild Australia, as it then was and, with access to integrated circuits, his enthusiasm knew no bounds.

Out of all this "midnight oil" research, and with the co-operation of John Crocker, came two hybrid analog/digital synthesisers, designated officially as "Qasar I" and "Qasar II".

An Arts Council Grant helped in 1973 and the ambitious "Qasar M-1" fol-



A close-up view of the VDU (Video Display Unit) screen showing a pattern identified with Page 8 — the sampling of external sound. Note the light pen clipped to the right hand side of the panel. The keyboard in the foreground is a normal alphanumeric computer style unit but the user program is as suggestive as possible of musical notation.

lowed, developed in conjunction with the late Don Banks, a senior lecturer at the Canberra School of Music, and a leading exponent of electronic music.

In 1975, Fairlight became associated with the project and the present CMI — Computer Musical Instrument — is a streamlined, rationalised and commercial version of the development M-8, the latter still having an honoured place in Anthony Furse's home.

But the push and worldwide initiative behind the CMI, nowadays, is Fairlight all the way.

While the CMI is correctly described as a Computer Musical Instrument, it is not a single rigid assembly but a number of free-standing modules interconnected with cables.

CENTRAL COMPUTER

At the heart of the instrument is the central computer unit — a large rectangular box, as shown, containing the logic circuitry and memory banks on plug-in PC boards, plus two floppy-disk magnetic data stores. Fairlight state that "the CMI uses four Motorola microprocessors in its architecture."

Also provided are an array of interconnection and input/output sockets, plus audio-in and audio-out facilities and the necessary analog-digital-analog converters. Audio-in can be from microphone or line, with audio outputs available to headphones, loudspeaker (20W, 8Ω) or multiple lines.

In a studio or sound laboratory situation, connection would normally be made to other on-the-spot audio installations.

One key peripheral component is a VDU — Video Display Unit — giving a "green screen" monochrome image with very high resolution. The VDU has a variety of roles; amongst other things, it identifies and gives the user access to the programs and other facilities stored on the floppy disks and in the computer's memory.

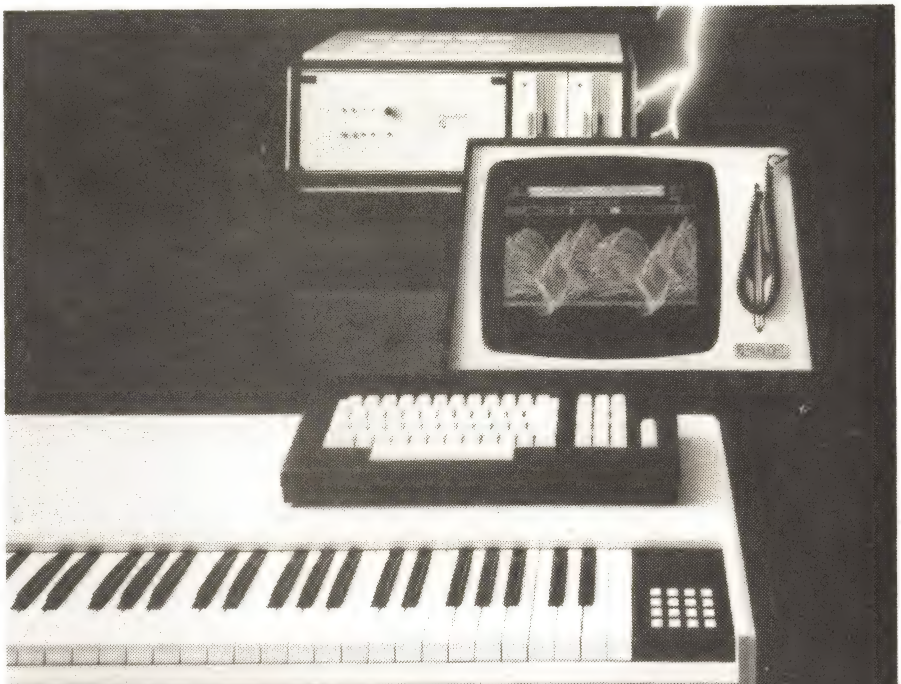
For example, when the unit is first switched on, the graphics on the screen will indicate the memory loading routines and, this done, display the first information "page" — Page 1, Index. This may remind the user that Page 2 lists the synthesised waveforms available on a library floppy disk in the right-hand disk slot.

Or the index may direct the user to Page 3, relating to the use of one or more peripheral music keyboards. Pages 4 and 5 have to do with synthesis of waveforms by the addition of harmonics, while Page 7 allows waveforms displayed on the VDU screen to be directly modified by means of an associated light pen.

Still other pages relate to facilities for manipulating attack, decay, level, vibrato, glissando, etc, or the sampling of real-life sounds via microphone or analog recording. Or, yet again, the composition of music by typing musical notes and instructions directly on a computer style keyboard, using the video screen to display the user's input.

The synthesis of sounds by the addition of harmonics is a way-out extension of the idea behind the original Hammond organs. By a system of slide potentiometers, the organist, in these days, could synthesise tones by adding to the 8ft fundamental selected proportions of the 16ft sub-harmonic and of

Mr Kyoshi Matsushita (left) with Fairlight's Managing Director Kim Ryrie at the Fairlight factory in Sydney. Mr Matsushita said: "We look forward to a long and enjoyable relationship with Fairlight".



From the rear: the central computer unit including audio circuitry and floppy discs; the VDU with light pen; the computer style keyboard; the 6-octave music keyboard. The small numeric key pad at the front-right can be used as a tone selector — in the manner of organ stops — for stage performances.

the lower order upper harmonics.

The CMI goes far beyond this by making available on call a string of up to 32 harmonics.

And, in this modern day and age, they are not called up by a similar array of slide potentiometers. The amplitude of the harmonics can be displayed as a bar graph on the VDU screen, rather like the display on a hifi graphic equaliser. Control of the amplitude of any given harmonic is achieved opto-electronically by holding a light pen against the particular bar on the screen!

Alternatively, the actual waveform can be viewed, enabling the user to study the connection between harmonic structure, wave envelope shape and the sound, as heard through phones or loudspeaker. (We understand that the CMI does not have provision to manipulate the relative phase of harmonics, on the grounds that it is tonally not very significant).

What the CMI does provide is the facility for the observer to modify the shape of a waveform displayed on the screen, or even to draw in a waveshape, using the light pen.

The sampling of everyday sounds is also an extension of an electronic organ technique — in this case used in Allen digital organs. Allen's technique is to sample the waveform from a particularly meritorious or interesting pipe, record the envelope shape in digital form and preserve it on a plug-in card or in an internal ROM memory chip. The waveform is then "clocked out" at frequencies determined by the playing keys, so that the one basic waveform becomes the foundational tone for a whole rank of electronically simulated pipes.

Because the CMI may be involved in a whole array of everyday non-repetitive sounds, it cannot manage with a single sample waveform. Instead, it uses its extensive memory resources to record a whole train of waves relating to a particular sound, which therefore contain information about progressive changes in amplitude and harmonic structure.

Recorded in digital form, such data can be modified as necessary and clocked out at any desired rate to simulate different musical pitches. So while the CMI could simulate an organ, if it had to, its resources are more likely to be directed towards the creation of sounds which are not readily achievable by other means.

So, if someone wants to build a melody from the crash of breaking glass, or the barking of a dog, it would be logical to turn to the CMI.

As a decided bonus, the CMI can readily be triggered by external signals, making it possible to achieve superb synchronisation in film or tape sound tracks, as for TV commercials.

As mentioned earlier, the CMI can be used in conjunction with a normal 72-note touch-sensitive keyboard, making it immediately accessible to keyboard musicians. Indeed, with the central unit out of sight and with no VDU connected, it can be used in a group situation, with plug-in expression controls, but with a range of totally novel pre-set voices.

In this role, the keyboard is polyphonic to a limit of eight keys but the capability can be dispersed as desired to as many as eight different keyboards or other player-instrument operating in monophonic mode.

While this offers tremendous versatility, it does limit the instrument to the capability of the players. And it would also limit the achievement of a composer who lacked keyboard fluency.

To meet this situation, the CMI has a sequencer which can assemble and play in real time eight-note polyphonic melodies which have been entered into the memory, however tediously, by an ordinary typewriter/computer style keyboard.

To use this facility, the operator obviously needs to know much about musical scoring and notation, but little about programming, in the computer sense.

Following a prepared routine, the composer enters on line (say) 0010 information about key signatures, rhythm beat rate and the octave in which the music is pitched.

Then, on lines 0020, 0030, 0040, etc, he/she simply types in the notes

CRAIG Car Stereo

One of America's top-selling car stereo equipment ranges is now available in Australia through a national network of specialist car sound dealers. A Sydney company, which specialises in car sound equipment – Sonic International – has the Australian distribution rights for the Craig "Road Rated" car stereo, which has an established reputation for quality and performance. Mr Martin J. McMurray, General Manager of Sonic International, said the Craig Corporation "is the third largest seller in the American car sound industry".

Initially, the Craig range in Australia will comprise seven radio/cassette units, nine alternative loudspeaker selections and a choice of power amplifiers up to 30W per channel. A "Road Rated" cassette player, the Craig T619 radio/cassette unit features Dolby NR, auto reverse, locking fast forward and rewind, electronic track selection, and an in-built power output of 12 watts per channel. The "flagship" model T693 provides electronic preset station selection for both AM and FM. For further information: Mr M. J. McMurray, Sonic International, 4 Clarendon St, Artarmon, NSW 2064. Phone (02) 439 8900.

SUB-WOOFER SYSTEM

MASSIVE PRICE BREAKTHROUGH!!!

A Sub-Woofer System makes a lot of sense. Apart from getting down to a genuine 30Hz you could actually save money over all.
For years we have been persevering with huge 12" 3 or 4 way systems in up to 120 litre cabinets to try to get down to – at best 45Hz. We have even duplicated our effort by having a stereo pair for this frequency!!!
Big 12" systems don't come cheap. With a Sub-Woofer you can forget about what happens below the non-stereo <100Hz region. Once that's done you are free to use a very compact (and generally far cheaper) system for stereo. Concert hall sounds in your lounge room without needing an auditorium to house your speakers.!!!
The profit you make from selling your 12" system could pay (or even exceed) the cost of the Sub-Woofer system. – AND you can get down to 30Hz!!!

1812 LIKE NEVER BEFORE. So too those big pipe organ records. This system is a must for the direct or digital disk enthusiast.
Now that "ELECTRONICS AUSTRALIA" have designed *a Mosfet Sub-Woofer filter/amplifier and speaker system you have no excuse.

JAYCARS' BULK BUYING PASSES SAVINGS ONTO YOU. TRULY A PRICE BREAKTHROUGH FOR SUB-WOOFER SYSTEMS.

*(With due respect to Thiele, Small, Snyder and others!)

THE SUB-WOOFER

This unit has been extremely popular with audio enthusiasts right across Australia! EA have designed a special crossover/booster amp just for this unit. Now you have no excuse to build a subwoofer system to enjoy those thrilling low notes from pipe organs, synthesisers, 1812 cannons etc!!

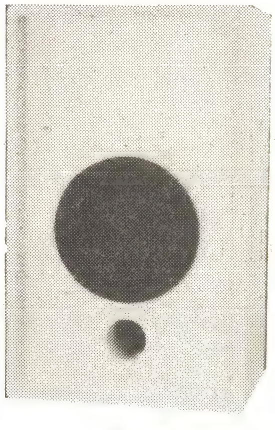
SPECS:
Diameter 10" (250mm) Cast frame. QT= 0.39 VAS= 63l
Power handing = 100WRMS.
Free-Air Resonance-32Hz±1Hz
Voice Coil=2" (51mm) DIA.
Magnet Assy:3kg(6.6 lbs)

A FREE SUB-WOOFER CABINET DESIGN IS PROVIDED WITH EACH UNIT!

ONLY $79.50

MODEL SW 250

THE ENCLOSURE * * * *



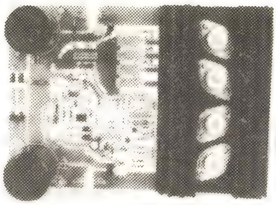
This compact 63 litre vented enclosure was specifically designed around the parameters of the SW 250 Sub-Woofer. It follows the theory pioneered by the work of Thiele, Small and Snyder. The Jaycar enclosure is easy to build and is made of high quality durable materials. The heavy walled cabinet is covered with an attractive black vinyl veneer. All timber is pre-cut and the black grille is already made. Assembly takes less than one hour.
NB. The photograph shows the prototype which was finished in white. The production units are only available in black.

ONLY $79.50

FREIGHT ANYWHERE $10

AMPLIFIER/ FILTER UNIT

Ref. EA
JULY 1982



ONLY $79

State-of-the art power Mosfet technology combined with an active low pass filter results in a sub-woofer amp without equal anywhere!!!

FEATURES: Around 100WRMS Drive capability
Low pass (sub-woofer) filters on board.
Can hook up to preamp out or power-amp out.
Power supply on board.
(Transformer needed. ONLY $39.50)

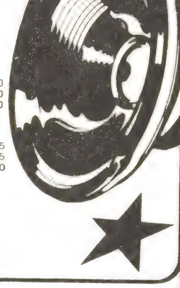
AMPLIFIER/FILTER UNIT.

Amplifier Module	$79
Transformer to suit	$39.50
Metal case specially made to suit including front panel, hardware etc. (not a twin 25 case). Only	$29.50
	$148.00

Buy the lot for only $125.00 if you purchase the enclosure and woofer at the same time.

LAST CHANCE~ PERHAPS?

PLESSEY–FOSTER



Over the last few months we have sold hundreds of famous Plessey Foster Speakers at great prices. Whilst we admit we had plenty of stock to sell (of some models) we are just about at the end. Genuine Bargains!!!

We still have a small quantity left of the stock shown below

P.A. SPEAKERS
12" 50W RMS C300K05 NORMALLY $69.50
NOW $39.50
SAVE $30.00
10 pcs OR MORE $29.50 · UNBELIEVABLE!!!

HI FI/GENERAL
12" 20W RMS C300L05 NORMALLY $29.95
NOW $19.95
SAVE $10.00

JAYCAR – OPENING NEXT MONTH AT CARLINGFORD, RIGHT AT CARLINGFORD COURT, NEXT TO KENTUCKY FRIED CHICKEN.

MOTOROLA

PIEZO HORN TWEETERS

KSN1005A 50W RMS PA HORN	$16.00
KSN1025A 100W RMS PA HORN	$26.00
KSN1038A 50W RMS PA/HI FI HORN	$16.00
KSN1039A 50W RMS HIFI/CAR RADIO DOME	$12.00

Jaycar

125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293

NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Mail Orders To:
Box K-39 Haymarket 2000

Post and Packing charges
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

with a few simple intervening signs such as + to indicate one octave up, R to signify a rest, = to indicate double speed, etc.

A stereo demonstration tape supplied to us by Fairlight contained a variety of sound that was nothing short of startling, both in its variety and in the sheer tonal complexity achieved, when raised to orchestral proportions by multitracking. The cassette, "Just Fairlight Number Three", contains snatches from 25 tracks, all CMI-synthesised sound, patched and faded into an 18-minute sound documentary — with and without superimposed voice.

At the end of the exercise, the CMI can produce a melody that has never before been played or which may, indeed, be unplayable in terms of normal fingering. And, if something needs to be modified, it is no more difficult than modifying any other computer program.

With the kind of versatility indicated even by these rather superficial observations, there is good reason to believe that the CMI has turned the player/instrument upside down.

With even the most complicated electronic organs and the early generations of synthesiser, musicians could ultimately explore and exhaust their total resources.

With the CMI, with its extensive hardware and its receptiveness to newly created ideas and software, there seems to be no end to the concepts that remain to be investigated.

Anthony Furse put it this way:

"The early synthesisers were interesting in their day, but their performance was technology limited. Working with oscillators, shapers, gates and so on, we could not keep ahead of the musicians. Now the boot is on the other foot."

And from Dr Robert Moog comes this tribute:

"It's spectacular when you get into this machine.

"I'm not going overboard . . . This is the feeling I've had in the six months since I started using the Fairlight.

"There really is no limit; nothing ever converges in it. You begin to work on something and out of that comes three or four other ideas.

"What it does is just too useful musically and too general and too versatile to be limiting in any significant way."

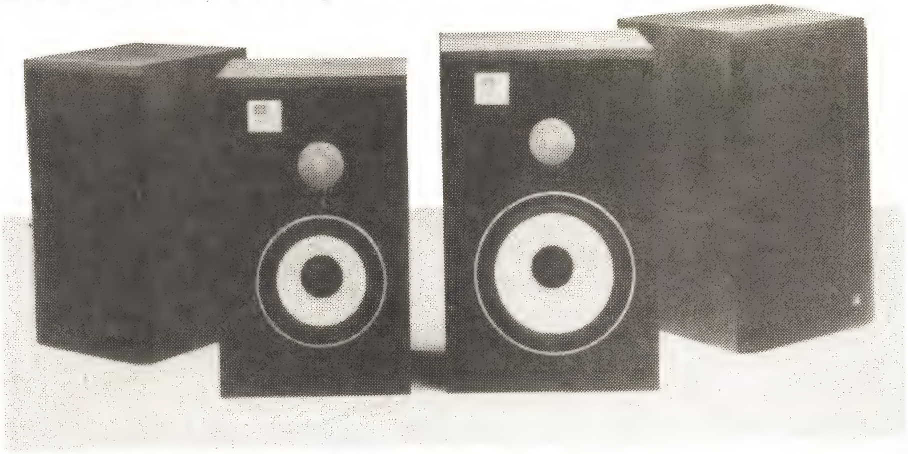
Perhaps that's why Matsushita, who have enormous research facilities of their own, decided to sign a marketing agreement with a small but dedicated group "down under".

For further details: Fairlight Instruments Pty Ltd, 15 Boundary St, Rushcutter's Bay, NSW 2011. Phone (02) 331 6333.

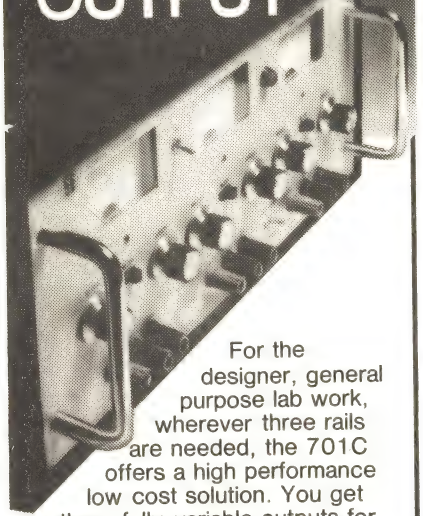
In Brief

HOME MUSIC TAPING is a multi-billion dollar industry in the United States, according to a recent survey made by Warner Communications Inc. In fact, they quote the commercial value of the

Bookshelf loudspeakers from JBL



James B. Lansing Sound Inc have introduced two new high performance bookshelf loudspeaker systems which, they claim, share much of the technology from their larger JBL domestic and professional models. Designated as types L46 and L56, they can be used with amplifiers delivering between 10W (min) and 100W (max) per channel. The L46 measures 527(H) x 317(W) x 267(D) mm and has an SPL rating of about 88dB (1W, 1m). The L56 is slightly larger and offers somewhat extended bass response. For further details, contact Harman Australia Pty Ltd, Unit A2, 6-8 Byfield St, North Ryde, NSW 2113. Phone (02) 887 3233.



POWER
THE SAVINGS OF TRIPLE OUTPUT

For the designer, general purpose lab work, wherever three rails are needed, the 701C offers a high performance low cost solution. You get three fully variable outputs for less than the cost of three power supplies — with added versatility and convenience.

- ☐ Excellent availability, designed and manufactured in Australia.
- ☐ Three outputs
  0- 8 volts...0-4 amps
  0-25 volts...0-1 amp
  0-25 volts...0-1 amp
- ☐ Panel meters can be switched to monitor voltage or current.
- ☐ Voltage and current fully adjustable to zero by Ten Turn controls.
- ☐ All outputs constant voltage/current limited.
- ☐ Automatic crossover.
- ☐ 25 volt outputs have two modes:
  (a) Each output completely independent.
  (b) Auto Tracking. The slave (−) tracks the master (+).
- ☐ Short circuit proof operation.
- ☐ Low cost — high performance.
- ☐ Complete product support — Sales, Service, Data.

Scientific Electronics
6 Holloway Drive, Bayswater, Victoria, 3153.
Tel. (03) 762 5777 Telex AA36308
Distributors
Victoria, Electro Technics 699 2716
N.S.W., Electronic Developments, 438 2500.
S.A., Graphic Electronic Industries, 42 6655.
Qld., Fred Hoe & Sons 277 4311.
W.A., W.J. Moncrieff Pty. Ltd., 325 5722

THE POWER SUPPLY SPECIALISTS

The compact, lightweight video system, developed by Funai and hitherto identified in Australia with Technicolor and Dynavision, is now being distributed also by Hanimex. Weighing between them, only 3.3kg, the camera and recorder can operate alternatively from an internal rechargeable battery, from a 12V source in a car, or from a mains power unit cum battery charger (illustrated). The special video cassettes, about the size of an audio cassette, offer a playing time of 30 minutes, although 45 and 60-minute cassettes are expected shortly. The signal can be readily dubbed to other formats. For information: Mr Bert Heyman, A/V Division, Hanimex Pty Ltd, 108 Old Pittwater Rd, Brookvale, NSW 2100. Phone (02) 938 0230.

music and entertainment taped in homes as 2.85 billion dollars. The activity accounted for more than 600 million dollars worth of blank tape, used mainly by adults 24-30 years of age, in the upper socio-economic group. The 52-page report is available free from the Information Dept, Warner Communications Inc, 75 Rockefeller Plaza, New York, N.Y. 10019.

STEREO AM has received the go-ahead in the United States but not in very happy circumstances. Originally, the FCC endorsed the Magnavox system but came in for so much industry flack, that it backed away from the decision. It then took the stance that the industry should reach its own decision, provided that such decision did not in any way prejudice mono AM compatibility. But then someone woke up that co-operation between two or more majors in the industry might be seen as collusion by anti-trust authorities, so the industry had to back away.

According to the latest reports, patent holders for the five competing systems are currently rushing in five different directions: Motorola, Harris Kahn, Belar and Magnavox. It is being said that the decision might actually be taken in the receiver laboratories of Japan, but this leads to the further thought that the Japanese may actually come up with a sixth system!

A spokesman for the US, Electrical Industries Association, Jack Wayman, has expressed the fear that confusion over systems might cause a repeat of the negative influence which sank quadraphonic systems a few years back.

PC STEREO PTY LTD advise that they have received stocks of four new audiophile recordings from Tioch Productions in the USA. All are from Soundstream digital masters, pressed on Teldec vinyl from Germany. Of special interest, also, is the fact that they feature Australian orchestras. TD1001 features the Melbourne Symphony orchestra with "The 1812 Overture" and "Bolero". TD1002 has the Adelaide Symphony Orchestra with "The Nutcracker" and "Coppelia". TD1003 and TD1004 also feature the Adelaide Orchestra, each with about six well known classical excerpts. Conductor in all cases is Jose Serebrier. For details: PC Stereo Pty Ltd, PO Box 272. Mt Gravatt, Qld 4122.

WEA RECORDS PTY LTD, one of the Warner group of companies, have appointed M.R. Acoustics (P.O. Box 165, Annerley, Qld (4103) as their sole Australian distributor for audiophile records whose copyright is held by WEA. Labels involved at this stage Nautilus, Mobile Fidelity and Direct Disc.

LOOKY VIDEO

MAIL ORDER DEPARTMENT: PO Box 254, Heidelberg, 3084.
Phone: (03) 435 3004, Monday — Saturday 1.00pm to 6.00pm

NEW PRICES:
OHIO SOFTWARE & HARDWARE

OHIO SOFTWARE:	
K1 Hardware Catalogue (incl new boards)	$1.98
K2 Software Catalogue (over 200 pieces)	$2.98
OHIO HARDWARE:	
C4P, VIDEO BOARD (converts C1P Series 7)	$130.00
COLOUR BOARD — C1P — Series 2	
H13A Short Kit, including documentation	$35.00
H13B = H13A and tracks for 5v to 12v DC	$39.00
H13A Colour and RF out. Assembled and Tested	$85.00
H13B = H13A Assembled and Tested includes 5v to 12v tracks	$89.00
OPTIONS:	
SOUND — Parts Kit	$2.50
incl assembled and tested	$18.00
VIDEO — Parts Kit	$2.50
incl assembled and tested	$15.00
5v to 12v DC — No Kit available (Specialised) — incl assembled and tested	$24.00
COMBINATIONS:	
Sound and 12v assembled and tested	$36.00
Video and 12v assembled and tested	$35.00
All 3 mods (H13B) assembled and tested	$45.00
"H13B — Deluxe" — All mods assembled and tested ($89 and $45)	$129.00

Note: All prices include sales tax.

COMPUTER EARS — SPEECH PROCESSOR for PET, OHIO, VK101, TANDY, APPLE NASCOM — Specify	*$49.00*

Write for SALE Price List — FREE.

ITOH 8510A!

THE MOST REMARKABLE DOT-MATRIX PRINTER FOR UNDER $1000!

FULL CHARACTER SET WITH MATHS SYMBOLS, GRAPHICS AND LOWER CASE DESCENDERS.
120 CHARS PER SECOND BI-DIRECTIONAL LOGIC-SEEK PRINT.
FULL PRECISION PROPORTIONAL PRINTING FOR LETTER-QUALITY WORD PROCESSING.
UP TO 136 COLUMNS ON 9½ INCH PAPER. (15-INCH MODEL AVAILABLE).
NEGATIVE LINEFEED CAPABILITY.
TRACTOR & FRICTION FEED BUILT IN.

AVAILABLE FROM:

Software Source Pty Ltd.

89 Oxford Street,
Bondi Junction. 389 6388
P.O. Box 364, Edgecliff 2027.

DEALER ENQUIRIES INVITED

HIFI REVIEW

Phonic SA-3000 stereo graphic equaliser

While there are many graphic equalisers on the market there are few with an inbuilt spectrum analyser. One such is the Phonic SA-3000, a 10-band stereo equaliser with bar graph spectrum display.

Input and output facilities of the Phonic SA-3000 are fairly standard. It has switches for bypass and equalised recording, as well as a switch to replace the tape monitor loop of the system that it is used in. In the centre of the panel it has two push-buttons. One selects the channel to be displayed (left or right) and one reduces the signal to the display by 20dB.

Presentation of the Phonic SA-3000 is good. It is well finished and the controls work smoothly. Each of the slider controls has a centre detent. The spectrum display is a blue fluorescent bar graph type with 10 bands to match the equaliser controls.

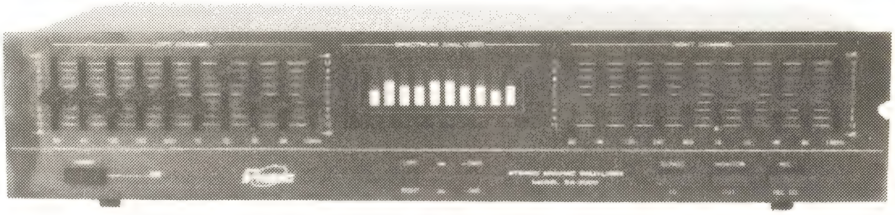
Dimensions are 431 × 245 ×91mm (W × H× D) and mass is 4.2kg. Semiconductor complement is 23 transistors, 32 diodes and 15 ICs. Imported from Taiwan, the SA-3000 appears to be well made and to be reasonably easy to service, should that be necessary. The only quibble that we had involved the exposed nature of the internal mains wiring.

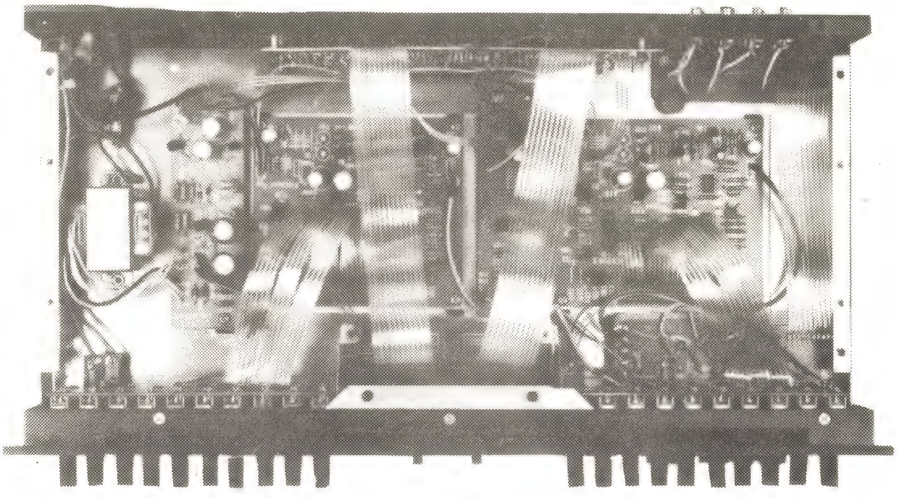
One point must be made clear from the outset and that is that the SA-3000 does not provide the facilities of a graphic analyser such as our own Playmaster design with TV display featured in the March '81 issue of EA. So the SA-3000 does not have an inbuilt pink noise source or input facilities for a calibrated microphone. The "spectrum analyser" is used solely to display program content at the equaliser output.

As such, it can show the effect of boost and cut applied by the controls but it is of no use for "room analysis". This is a pity really since the display is the major part of what is needed for such a graphic analyser. As a program display the response time is really a little too slow and the Q of the display filters would have to be increased to make it useful as an analyser.

On test, the Phonic SA-3000 performed well and met or exceeded all of its specifications with the exception of the maximum output signal delivered into a 10kΩ load. The specification stated 7V RMS while we measured the worse of the two channels at 4.5V RMS with non-symmetrical clipping. This is still more than adequate for most situations though.

Maximum boost and cut on all bands is specified at ±12dB and we measured a result close to this figure overall. Worst case harmonic distortion was 0.12% with all controls at full boost but the more typical figure was around 0.02% at 1V RMS, as specified.





Signal to noise ratio was 89dB referred to 1V RMS with hum components removed and 78dB including hum. When referred to the more usual "tape monitor loop" level of 150mV RMS, these figures are reduced by 16dB, which means that the SA-3000 is reasonably quiet but not outstandingly so. Separation between channels was −76dB at 100Hz and 1kHz and −57dB at 10kHz, which is good.

As with most owner's manuals supplied with graphic equalisers, the four-page sheet with the SA-3000 gives no guide at all as to the best way of using it to best advantage. It does, however, give a full circuit diagram, which is something to be grateful for. Should service be required, most of the parts are readily available off the shelf. The gyrators employ the National Semiconductor LM348 quad op amp ICs.

In summary, the Phonic SA-3000 performs as well as most other 10-band graphic equalisers although its graphic display really does not serve much purpose. With a little more circuitry it could have represented a real breakthrough in providing an economical equaliser and analyser combination.

Recommended retail price is $250. Further information can be obtained from Freedman Electronics Pty Ltd, 91a Liverpool Road, Summer Hill, NSW 2130. (L.D.S.)

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070, MELBOURNE, VICTORIA. Ph (03) 489 8131. Telex No. 38897

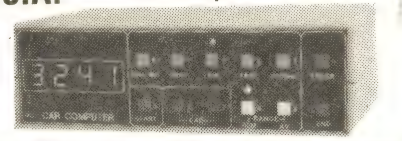
100W Woofer Enclosure

Check our prices

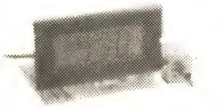
Ultrasonic Rule

$49.00

P.O.A. Car Computer

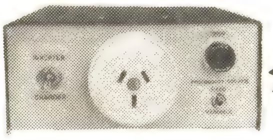


Tacho/dwell meter with digital display



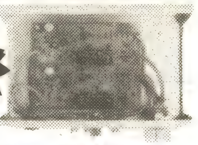
$54

12/240 volt Inverter

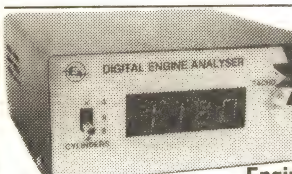


$55

$35

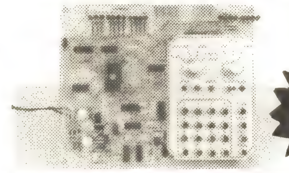


Universal preamplifier for MM/MC cartridges



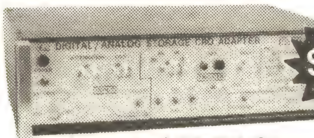
$48.50

Engine Analyser Kit



Eprom Programmer

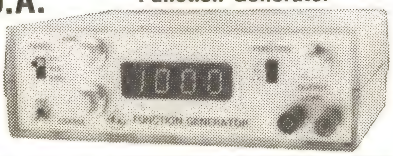
$55.00

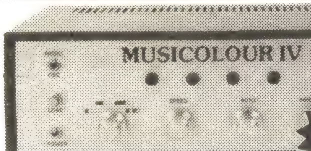


$169.00

Analogue and Digital Storage CRO Kit

P.O.A. Function Generator

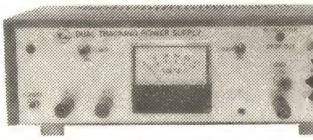




$79.00

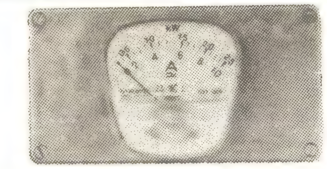
Onto our 3rd run of this kit.

Duel Tracking Power Supply



$86.00

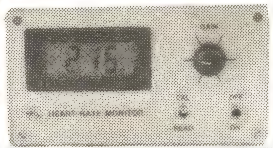
Power Monitor



P.O.A.

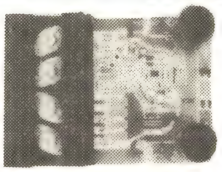
Portable 3½ Digit Heart Rate Monitor

$70.00



100w Sub-Woofer Amplifier

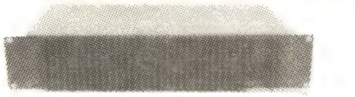
$85.00



ETI 5000 Pre Amp $239

Come in and hear the fantastic combination of the ETI5000 power amp & preamp playing through the ETI4000/1 and 2 speaker systems. EX STOCK.

ETI POWER AMP ONLY $279



The front panel is now better finished than ever and has no holes visible. The fins themselves are tapped from the rear. Complete kit price is just $275. Remember the super finish front panel at no extra charge. EX STOCK.
We have now sold 150 of this kit and expect to sell hundreds more.

LE GONG

Fantastic doorbell using the new Siemens SAB 0600 chip.
Kit of parts $15

INCREDIBLE!!!

E/A has really done it this time. Display your Hi/Fi response on your colour TV. It will really impress your friends. Kit of parts $99

Over 200 Sold

			$
ET729	UHF TV Masthead Amp	Apr 81	36.00
ET730	UHF TV Converter	May 81	37.50
ET760	Video Mod. to suit 660 Micro	Spt 81	14.50
ET1501A	Negative Ion Generator	Apr 81	39.00
	Dream 6800		109.00
	Dream 6802		109.00
	Pwr. Supply to suit Dream Micro Kit		29.50
	Hex Keypad 19 Keys		28.50
79TI11	Transistor Assisted Ign.	Nov 79	34.00
79UPS6	Universal Power Supply	Jun 79	29.50
80TC12	Bipolar Train Controller	Dec 80	28.00
80CM3A	Digital Capacitance Mtr.	Mar 80	52.50
80PG6	TV Pattern Generator	Jun 80	52.50
80TV8	TV CRO Adapter	Aug 80	29.00
80LL7	Leds & Ladders	Jul 80	19.50
80BM10	Car Battery Monitor	Oct 80	6.50
80SA10	Stereo Amp Mosfet	Jan 81	169.00
80DC10	Digital Storage Cro Ad.	Nov 80	78.00
80LS12	Selectalott	Dec 80	22.50
80LBR12	Light Beam Relay	Nov 80	13.00
80FB12	Guitar Fuzz Box	Dec 80	19.50
80TM8A	Digital Engine Analyser	Aug 80	48.50
80PP7A	Eprom Programmer	Jul 80	72.50
80RM12	CylonVoice Stimulator	Jan 81	18.50
80RAM12	RAM Expansion for Dream	Dec 80	39.00
80PA6	Playmaster 300W Amp Module	Jun 80	63.00
80TRS11	TRS 80 Printer Serial In.	Nov 80	15.00
81DC2	Le Gong Doorbell	Feb 80	15.00
81GA3	Colour Graphic Analyser	Mar 81	99.00
81IR4A	Infra-Red Relay	Apr 81	39.00
81SP1	RS232 TRS80 System 80 In.	Feb 81	15.00
81SW1	Oscilloscope Switch	Feb 81	58.00
81DC3B	Digital/Analog Store. Cro.	Mar 81	169.00
81WS10	Wind Speed Indicator	Oct 81	43.50
81P6	Pool/Lotto Selector	Jun 81	24.50
81A010	Audio Test Unit Cass. Deck	Oct 81	47.50
81MC8	Musicolour IV	Aug 81	79.00
81SG9	LED Sandglass	Spt 81	22.50
81CI9	Digital Clock Thermometer	Spt 81	80.00
81SS11	Slide Cross Fader	Nov 81	80.00
81GA9	Photon Torpedo Game	Spt 81	23.50
81SW7	Train Steam Whistle	Jul 81	17.50
81HB4A	Heart Rate Monitor	Apr 81	84.00
81SP5	Sound Pressure Meter	May 81	37.00
81OR7	Electronic Organ	Jul 81	59.00
81CH12	Christmas Decoration	Dec 81	15.00
81fm10a	500MHz Digital Freq. Mtr.	Dec 81	135.00
HE102	Guitar Phaser	Jun 81	25.00
HE103	Transistor Tester		9.40
HE104	AM Tuner	May 81	7.50
HE105	Basic Amplifier	May 81	9.50

			$
HE106	FM Radio Microphone	May 81	6.50
HE107	Electronic Dice	Jun 81	5.95
HE108	Power Supply		11.95
HE110	Unmistakabell		6.90
HE111	Ohmeter		19.90
HE112	Micromixer		11.90
HE117	House and Car Alarm		16.90
HE121	Scratch and Hiss Filter		9.00
HE127	Siren		3.90
ET043	Heads or Tails	Oct 76	3.50
ET044	Two Tone Doorbell	Oct 76	4.50
ET047	Morse Practice Set	Dec 76	3.50
ET048	Buzz Board	Dec 76	3.90
ET061	Simple Audio Amp	Oct 76	5.50
ET062	Simple AM Tuner	Mar 77	6.50
ET063	Electronic Bongos	Nov 79	5.00
ET065	Electronic Siren	Dec 79	5.50
ET066	Temp Alarm	Dec 79	4.90
ET068	LED Dice	Oct 76	5.90
ET072	Two Octave Organ	Jne 78	8.50
ET084	Car Alarm	Jan 77	12.00
ET147	Electronic Dummy Load	Oct 80	89.00
ET149	2 Tone Generator	Jul 80	34.90
ET157	Crystal Marker	Oct 81	34.50
ET158	Low Ohms Meter	Nov 81	29.50
ET256	Humidity Meter		19.50
ET257	Universal Relay Board	May 81	12.50
ET258	Mini Drill Speed Controller	Jul 81	8.00
ET326	Exp. Scale LED Voltmeter	Spt 80	12.50
ET327	Turn/Hazard Indicator	Oct 80	22.00
ET328	LED Oil Temp Meter	Jan 81	15.50
ET329	Exp. Scale Vehicle Ammeter	Feb 81	19.00
ET330	Car Alarm	Jul 81	27.50
ET332	Electronic Stethoscope	Aug 81	34.00
ET438	LED Level Meter		11.95
ET445	General Purpose Preamp	Jul 76	8.50
ET455	Loud Speaker Protector	Mar 80	25.50
ET458	LED Level Meter	Jne 81	27.00
ET466	300W Amp Module	Feb 80	63.00
ET467	4 Input Mike Preamp	Jul 80	27.50
ET470	60W Amp Module Series 4000 TPV 6		26.00
ET471	Audio Preamp Series 4000 TPV 6		45.50
ET472	Power Supply for Series 4000 TPV 6		24.00
ET473	Moving Coil Preamp Series 4000 TPV 6		54.00
ET475	AM Tuner	Spt 80	89.00
ET476	Series 3000 Amp 25W Stereo	Nov 80	84.00
ET477	Series 5000 Pwr. Amp Mod 150W	Jan 81	58.00
	Series 5000 Pwr. Amp Complete Kit		275.00
ET478MC	Moving Coil Preamp (5000)	Spt 81	18.50

Bankcard Mail Orders Welcome

Please debit my Bankcard.
Bankcard No. . . . .
Expiry Date . . . .
Name . . . .
Signature . . . .

Post & Pack $2.50 small kits, heavier kits add extra postage
Prices subject to change without notice. Send 60c and SAE for pricelists. Phone (03) 489 8131.
MAIL ORDERS: PO Box 235, Northcote, Vic 3070.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ELECTRONIC TOOLS FOR HOBBYIST AND PROFESSIONAL

MICRON 30 WATT

NEW FOR '82

This brilliant little 30 watt iron is just the "bee's knees" for the electronics hobbyist, electrician or home handyman. We searched the world for a low cost yet quality iron which met the criteria of ★ light-weight ★ screw in interchangeable tips ★ efficient thermal transfer from element to tip ★ tip temperature maintains within the limits suitable for electronic work and also small household jobs ★ and of course, fully S.E.C. tested and approved.

Comes fitted with T 2434 Tip

T 2430 . . . $ 9.95

REPLACEMENT TIPS

T 2434 Flat Tip 95

T 2435 Conical Tip 95

GENERAL PURPOSE WORKSHOP SERIES

★ 115mm Long ★ Drop Forged Steel ★ Box Jointed Construction ★ Insulated Handles

DIAGONAL CUTTERS

Suit medium to small work. Spring Return.

T 2010 . . . . $5.95

LONG NOSE WITH DIAGONAL CUTTER

Fine tips 2 mm x 3 mm 125 mm length. Chrome finish.

T 2030 . . . . $5.95

HEAVY DIAGONAL CUTTERS AND WIRE STRIPPER

Rugged cutters with 1.2 mm and 1.6 mm stripping holes. Ideal for wiring construction work.

T 2035 . . . . $5.75

SIDE CUTTING PLIERS

25 mm Jaws 150 mm Length
Ideal for Technician, Electrician. Super Tough!

T 2045 . . . . $5.95

LABORATORY SERIES

Finest carbon steel. Superb precision tools. Will withstand years of use. Box-jointed construction with finely aligned edges. Insulated handles. 110 mm length. Spring return action.

DIAGONAL CUTTERS

T 2050 . . . . $8.50

FLAT NOSE PLIER

Smooth jaws for delicate work.

T 2060 . . . . $8.95

MICRO TOOLS

Highly recommended for fine precision work. Finest carbon steel. Insulated handles.

MICRO CUTTERS 100mm (L)

T 2070 . . . $7.50

MICRO LONG NOSE PLIER 125mm (L)

Will handle work as fine as a human hair. Diagonal cutting edge.

T 2075 . . . . $7.25

QUALITY SCREWDRIVERS JEWELLERS DRIVER SET 6 PC

T 2200 . . . . $3.50

SHEETMETAL NIBBING TOOL

Cuts any shape cut out in steel, aluminium or plastic. Very easy to use. Capacity steel .6 mm. Aluminium 1.6 mm.

T 2355 $14.50

SHEET METAL BENDER (Panbrake)

Make your own chassis, boxes brackets etc. Unique slotted upper clamping bar allows complex corner bends etc.

Handles up to 16 gauge metal and up to 445mm wide.

New low direct import price!

T 2400 . . . . $65.00

WIRE WRAP TOOL

Ideal hobbyist tool or for use with prototypes etc. Strips, wraps and unwraps.

T 2384 . . . . $4.50

STRIP WRAP UNWRAP

NEEDLE FILE SET

Use for contacts, points, general electronic work. Very handy! Set of 5 files, round, square, half round, triangular and flat.

T 2350 . . . . $7.95

PIN VICE

Will hold small drills, taps, files etc. from micro size to 3 mm diam. Can be used in standard drill chuck, thus enabling use of drill sizes to .8 mm.

Used by fingers

T 2352 . . . . . $6.50

WIRE WRAP WIRE PACK

Handy pack of 5 metres of 30 gauge.

W 0320 75

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

* NEW KITS *

ADD A DECIMAL POINT • TO YOUR EA FREQUENCY COUNTER

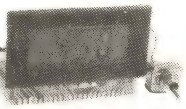
SEE PAGE 85 THIS MAGAZINE K2500

- ★ Kit as published EA July '82.
- ★ 2p4p slide switch included.
- ★ Enables direct measurement in MHz and u seconds.
- ★ IC sockets provided.

K 2502 . . . . $7.50

LCD TACHO/DWELL METER

SEE EA MAY '82



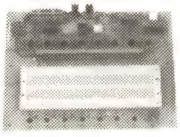
- ★ 15mm display
- ★ Suitable for 4, 6 & 8 cylinder vehicles
- ★ In dash mounting or use as a stand alone unit
- ★ Compatible with all ignition systems

K 2540 . . . . $54.00

ETI 145 PROTOTYPER

SEE ETI JULY '82

The only thing you can't do on this experimenters board is make a cup of tea!



Versatile unit featuring . . .

- ★ 3 power supplies
  - + 5V @ 150MA
  - —5V @ 18 MA
  - +1.25—10V @ 100 MA
- ★ Variable multivibrator 3Hz—600Hz.
- ★ Indicates positive and negative edge pulses.
- ★ ALTRONICS Kit complete in every way, including IC sockets and all hardware.
- ★ Uses intersil 7660 precision voltage converter.

★ ★ ★ SPECIAL BONUS ★ ★ ★

The ALTRONIC Kit includes a versatile power supply kit in lieu of the plug pack specified.

Handy 12VDC and 9VAC

K 1145 . . . . $69.50

LCD HEART RATE MONITOR

SEE EA JULY '82

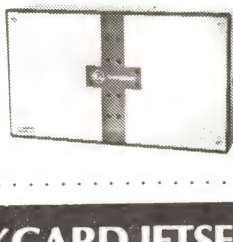
Portable unit requires no sensor attachments, just hold the unit in your hand for instant readout.

K 2550 . . . . $79.00

THEREMIN KIT

SEE EA JUNE '82

SUPERFUN WEIRD AND WONDERFUL MUSIC AND SCIENCE FICTION SOUND GENERATOR — WORKS ON HAND CAPACITY.



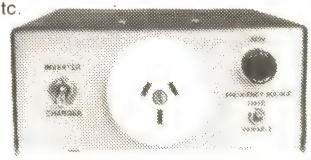
K1200 . . . . $29.50

GO ANYWHERE 240V PWR. KITS

See EA May and June 82. These great new inverter kits enable you to power 240V appliances for your car, caravan or boat.

40 WATT

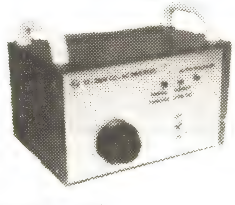
Suits small appliances i.e. turntable, tape deck, shaver etc.



K6700 . . . . $55.00

300 WATT

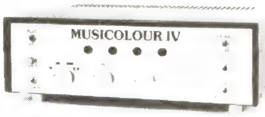
Use to power HIFI, TV set, mains lighting etc. Fully regulated and overload protected.



Low age rate xstal used.
All sockets provided for IC's.

K6750 . . . . $185.00

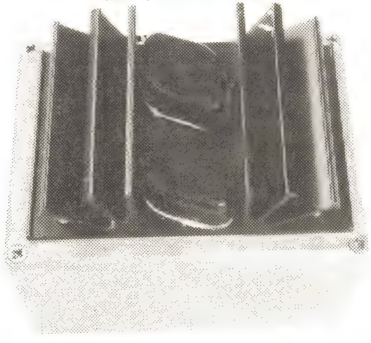
* THE EVER POPULAR MUSICOLOUR IV EA PROJECT *



Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.

K 1004 . . . . $79.50

TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION



Petrol $2.00 a gallon — Good Grief!

Yes, it's bad enough paying $2.00 a gallon for petrol without waisting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop. **Easy to build!**

K 1010. . . . . $35.00

★ ★ ★ ★ ★

$5.00 and $10.00 SALE HOBBY ELECTRONIC KITS

HE 103 Transistor Tester A must on every bench	$ 5.00	SAVE $ 4.50
HE 112 Micro Mixer Movie Buffs Delight	$10.00	SAVE $2.00
HE 113 Water Alarm Simple project tells you when your favourite plant is thirsty!	$ 5.00	SAVE $4.50
HE 114 Digital Counter and Display Versatile kit, Educational	$10.00	SAVE $3.95
HE 115 Reaction Tester Compatible with HE 114	$ 5.00	SAVE $1.95
HE 116 OP Amp Tester ★BARGAIN @ $3.00 ONLY		
HE 129 Simple Timer A multitude of household uses	$ 5.00	SAVE $1.95
HE 121 Scratch & Hiss Filter Give your old records new fidelity	$ 5.00	SAVE $4.50
HE 127 Simple Siren ★BARGAIN @ $3.00 ONLY		
HE 123 Alien Invaders Space Action Game	$10.00	SAVE $3.95
HE 197 LED Dice **NOW ONLY $5.00**		

★ ★ ★ ★ ★

VALUE PACKED EA AND ETI KITS TO CLEAR

K 7711 EA Sound Level Meter Kit (includes wooden Mic. Block)	Was $34.50	**NOW $25.00**
K 7715 ETI 561 Metal Detector Kit (includes prewound coil)	Was $29.50	**NOW $20.00**
K 7720 ETI 330 Car Alarm (Current Trip with Exit/Entry delay)	Was $28.50	**NOW $22.50**
K 7716 ETI 084 Car Alarm (Current Sensing type)	Was $12.50	**NOW $9.00**
K 7705 EA Photon Torpedo	Was $24.00	**NOW $16.00**
K 6055 EA Photographic Timer (Versatile Timing Unit)	Was $39.50	**NOW $28.50**
K 5105 ETI 479 Bridging Adaptor (300 Watts from 2 ETI 477 Modules)	Was $13.95	**NOW $8.95**

ALTRONICS

For Address, Phone No. and Despatch details see our Double Page Advertisement pages 16 & 17.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Circuit details and construction

CAR COMPUTER PART TWO

Electronics Australia
AUGUST 1982

Although the operation of our microprocessor-based Car Computer is quite involved, most of the complexity is concealed within three major integrated circuits. Construction is therefore relatively simple. This month we give the circuit and software details and describe construction.

by JOHN CLARKE

By far the most important integrated circuit used in the Car Computer is IC1, a Motorola 6802 8-bit microprocessor (MPU). This microprocessor can perform all the instructions of the well-known 6800 microprocessor and contains 128 bytes of volatile Random Access Memory (RAM), which can be used for data storage when running a program. Additional to this is the advantage that the first 32 bytes (8-bits wide) of RAM is separately powered, enabling important information to be retained when power to the main processor is switched off.

IC2, the Peripheral Interface Adaptor (PIA), supports the external hardware devices. In our circuit, IC2 is used to drive (write) the LED display, read the function select switches and detect the distance, fuel and time pulses. Two 8-bit ports, PA0 to PA7 and PB0 to PB7, are available and can be programmed as inputs (read) or outputs (write). On each port are two extra lines, CA1 and CA2 and CB1 and CB2 respectively. CA1 and CB1 are inputs and CA2 and CB2 can be programmed as either inputs or outputs.

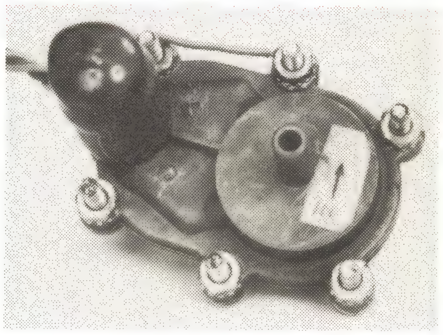
IC3 is a 2K byte Electrically Programmable Read Only Memory (EPROM), which holds the program for the Car Computer. This memory is non-volatile, which means that switching off the power to the IC will not erase the memory. The program remains stored indefinitely (unless erased by ultra-violet light).

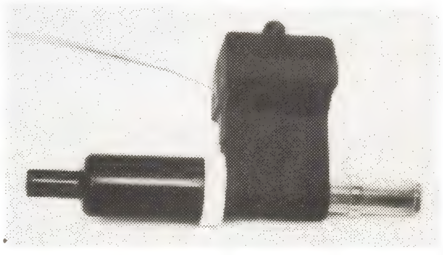
A common 8-bit data bus interconnects IC1, IC2 and IC3. This provides two-way (Read/Write) communication between these devices. An address bus (A0 to A10) connects IC1 and IC3 and this is used to access all the EPROM locations.

Simple address decoding for IC2 and IC3 is performed by two NAND gates, IC6a and IC6b. IC3 is accessible to IC1 when both the VMA and A14 lines are high, and IC6a brings $\overline{CE}$ of IC3 low. The VMA line, or Valid Memory Address line, indicates that a valid address is on the bus. The memory locations for the EPROM are from hexadecimal number 6000 to 67FF.

All the registers of IC2 are accessible by high, low combinations of RSO and RS1, which are connected to A0 and A2 respectively. However, these registers cannot be selected unless the Chip Select lines CSO, CS1 and $\overline{CS2}$ are true. CS1 is permanently held high and CSO is connected to the $\overline{CE}$ if IC3. When A15 and the VMA are both high, IC6b brings $\overline{CS2}$ low. Providing that IC3 is not selected with A14 high, then IC2 is selected. We used addresses from 8004 to 8007 to access the PIA.

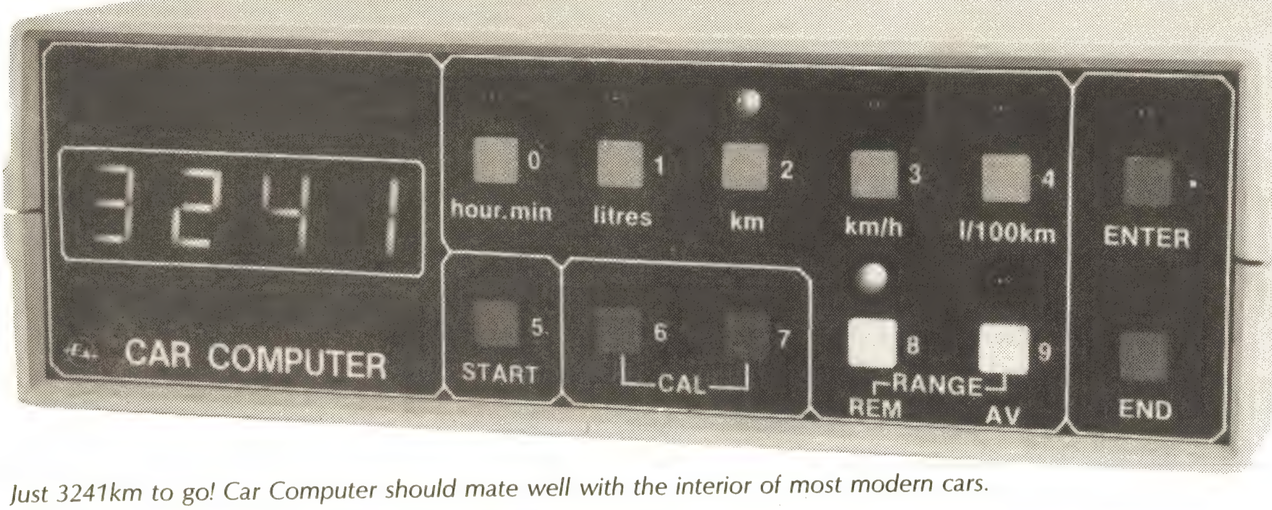
One point of interest here is why the $\overline{CE}$ of IC3 has been connected to CSO of IC2 to prevent both ICs being selected at the same time. The only time that this conflict could occur is when both A14 and A15 are high. Why not simply avoid addresses at and above C000 in the program? To understand this, it is necessary to further discuss the operation of IC1.


The Prince fuel flow sensor delivers 130 pulses per 0.1 litres of fuel flow.

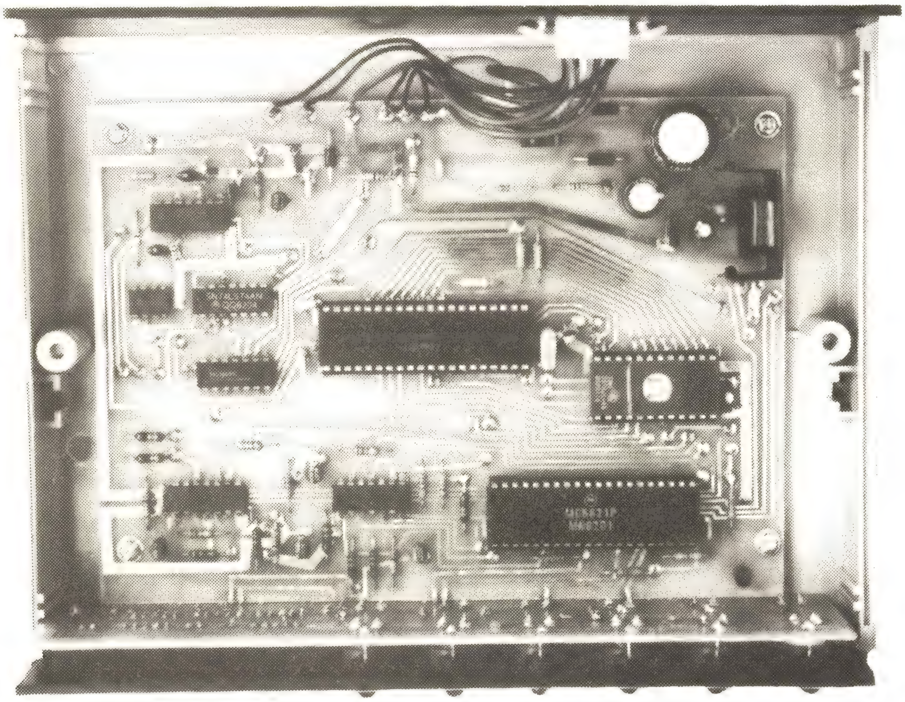

The alternative Moray fuel flow sensor delivers 1500 pulses per 0.1 litres, and is the unit we recommend.

Three programming levels are used in the Car Computer: RESET, Non Maskable Interrupt (NMI), and Interrupt Request (IRQ). The initiation of each of these programs is determined by the voltage levels (or edge triggering in the case of the NMI) on the respective hardware pins of IC1, pins 40, 6 and 4.

We shall discuss how the voltage levels at these pins are controlled and why we have used these levels of programs at a later stage. At present it is sufficient to say that to access the start address in the EPROM for these programs, IC1 looks at addresses between FFF8 and FFFF. This means that both A14 and A15 will be



Just 3241km to go! Car Computer should mate well with the interior of most modern cars.



View inside the assembled Car Computer. IC sockets are mandatory for the three main ICs, optional for others. Note clip-on heatsink fitted to the 7805 regulator.

high. Since we only want to access IC3 and not IC2, IC2 is disabled by the $\overline{CE}$ to CSO connection.

The advantage of using these program levels is that each has its own priority. At first power on, the Car Computer runs the "background" program initiated by the power-on RESET. This program continues to run until interrupted by either the $\overline{NMI}$ or $\overline{IRQ}$. If the $\overline{IRQ}$ pin were to go low, the processor finishes the current instructions and begins the IRQ program routine. Once this program is complete, the processor continues with the background program as though no interrupt had occurred.

If an $\overline{NMI}$ occurs during an IRQ routine, the processor immediately carries out the NMI routine, then reverts to IRQ and finally resumes the background program. The converse is not true, however – ie, if an $\overline{IRQ}$ occurs during NMI, the IRQ program is not run until the completion of the NMI routine.

Display multiplexing

This first priority of the NMI is put to good use by using it to multiplex the display. The display consists of four common anode 7-segment display digits and eight individual LEDs. The cathode of each display digit segment is connected to the corresponding cathode on the adjacent display, while the anodes of the function LEDs are also common. In order to light the display segments and the LEDs, it is necessary to switch on driver transistors Q1-Q5 at the anodes.

Each display is lit in turn and this is repeated at such a fast rate that the eye perceives a continuous display free from flicker. PA0 to PA7 on the PIA are used to send the correct segment of the display low at the appropriate time, while PB3 to PB7 scan the common anodes of the display digits. Note that 7404 inverting buffers, IC8 and IC9, are used to drive the cathodes of the display and the bases of the anode driving transistors. These buffers are necessary because the PIA output lines are incapable of supplying the necessary current.

Note also that the key switches are tied in matrix form to the digit scanning PIA outputs. If any switch is closed, this is read as a high signal on the PB0 to PB2 lines which are programmed as inputs. The rate at which these keys are scanned, and consequently the scanning rate of the display, is determined by the Schmitt trigger oscillator IC5a, which runs at close to 600Hz.

IC6c gates IC5a, allowing $\overline{NMI}$ to only occur when both CB2 and the IC5a oscillator output are high. Normally CB2 is high; however, during the initial stages of the RESET program (background program), initialisation must be completed before the NMI is allowed to proceed. The initialisation includes setting up the PIA lines as inputs or outputs and for interrupt inputs. This can be seen on the flowchart program beginning with RESET (Flowchart 1). Setting the CB2 line high occurs after the "B" connection point.

Flowchart 1 also shows what happens when the NMI routine begins. Firstly, leading zeros in the display memory are suppressed. Following this, a check is made to see if a switch is closed and the next display digit is lit.

The IRQ performs three functions, and is interrupted when either a time pulse, distance pulse or fuel pulse occurs. So that the processor can determine which of the three inputs actually caused the interrupt (after all the processor only has one $\overline{\mathrm{IRQ}}$ pin), it is necessary to send the signals via the PIA. The PIA sets flag bits within the PIA registers which correspond to the input causing the interrupt. The hardware outputs, $\overline{\mathrm{IRQA}}$ and $\overline{\mathrm{IRQB}}$, then interrupt the $\overline{\mathrm{IRQ}}$ pin of the processor.

CA1 and CA2 on the A half of the PIA are used to detect the pulses from the distance and fuel sensors respectively. CB1 on the B half detects the time interrupt.

When negative edges at CA1, CA2 or CB1 occur, the $\overline{\mathrm{IRQA}}$ and $\overline{\mathrm{IRQB}}$ signals, which are tied together, go low and trigger the $\overline{\mathrm{IRQ}}$ input of IC1. The $\overline{\mathrm{IRQ}}$ line only goes high when all interrupt flags within the PIA registers are cleared.

The time interrupt is derived from a 3.58MHz crystal connected directly to the crystal input pins (pins 38 and 39) of IC1. Inside IC1 is a divide by four circuit which provides the E clock (pin 37), and this is used for timing the entire program. The resulting 894.9kHz E clock pulse is buffered by IC6d and fed to the input of IC7. IC7, an MM5369 divider, is designed to provide a 60Hz signal when operated from a 3.58MHz crystal. Since we are operating it from a crystal-controlled source of one quarter this frequency, the output at pin 1 has a frequency of 15Hz.

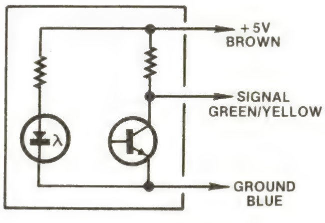


Fig. 1: MORAY FUEL SENSOR AND SPEEDOMETER CABLE DISTANCE SENSOR

The 15Hz signal is connected to the data input (pin 12) of IC4b, a 74LS74 D flipflop, and is transferred to the Q output when the clock input, pin 11, goes high. This clock signal is derived from IC6c and is also connected to the NMI of IC1. The NMI routine occurs on the negative edge of the $\overline{\mathrm{NMI}}$ clock and is completed well before the $\overline{\mathrm{NMI}}$ clock goes high, which is the only time that the $\overline{\mathrm{IRQB}}$ time signal can interrupt the $\overline{\mathrm{IRQ}}$ of the processor. This arrangement is necessary since the NMI routine contains an instruction which will clear the $\overline{\mathrm{IRQB}}$ interrupt; the very instruction which reads the key switches.

Flowchart 2 shows the logic operations which occur on an $\overline{\mathrm{IRQ}}$. Firstly, a check is made to see if a time interrupt has occurred and, if so, the time is updated. If the interrupt was not a time interrupt then a check is made to see if it was a distance or fuel interrupt, or both. The corresponding distance and/or fuel reading is then incremented.

Sensor operation

As indicated last month, two different fuel flow sensors can be used with the Car Computer. The unit represented on the main circuit diagram is the "Prince" fuel flow sensor and consists of a ball running in a circular race to interrupt a beam of light from a small bulb to a phototransistor. Collector current for the phototransistor is derived via a 4.7kΩ resistor and the ouput signal filtered by a .01μF capacitor and squared up by Schmitt trigger IC5e.

Fig. 1 shows the circuit for the alternative Moray fuel flow sensor. This device uses multiple vanes to interrupt a beam of light between a LED and a phototransistor, an arrangement which delivers 11½ times more pulses per litre than the Prince sensor. The only change necessary to accommodate the Moray sensor is that the 4.7kΩ resistor be deleted from circuit.

The distance sensor shown on the circuit diagram consists of a coil and rotating magnet assembly. As the magnets rotate, they induce a voltage in the coil. This signal is half-wave rectified by a 1N4002 diode and filtered with a 0.1μF capacitor and 100kΩ resistor. A BC549 transistor provides the necessary gain and, after further filtering by a 0.1μF capacitor, the resulting waveform is squared up by Schmitt trigger IC5d.

The alternative speedometer cable sensor uses the same circuit configuration as the Moray fuel sensor (Fig. 1). In this case, however, the distance sensor signal is applied directly to pin 11 of IC5d and the diode, 0.1μF capacitor, and 100kΩ and 56kΩ resistors deleted. The .01μF capacitor should be left in circuit.

We'll have more to say about the fuel flow and distance sensors in the third (and final) article next month.

Power for the Car Computer is derived from the 12V car battery. A diode and 1000μF capacitor filter the battery voltage and a 7805 three-terminal regulator supplies +5V directly to the Vcc standby of IC1. Thus, power is permanently supplied to the first 32 bytes of RAM. The 10μF tantalum and 10μF electrolytic capacitors ensure stability of the regulator.

Transistor Q7 is used to switch the power to the main circuit on and off under the control of the ignition switch. When the ignition switch is turned on, current flows through an 82Ω resistor and series 1N4002 diode and turns Q7 hard on. Since Q7 saturates, the main circuit is effectively connected to the +5V output of the three terminal regulator.

With power on, the crystal oscillator in IC1 starts and the resulting $\overline{\mathrm{E}}$ signal is applied to the clock of D flipflop IC4a. At the first positive edge of this clock, the $\overline{\mathrm{Q}}$ output connected to the $\overline{\mathrm{RESET}}$ and RAM Enable (RE) of IC1 is set low. When the 1MΩ resistor charges the 0.1uF capacitor at the input of Schmitt trigger IC5c, the output of IC5c goes low and, at the next positive clock transition, the $\overline{\mathrm{RESET}}$ goes high, allowing the RESET program to begin.

When the ignition is turned off, power to the 82Ω resistor is disconnected and the current driving the base of Q7 from this source is removed. Q7 does not cease conduction immediately, however, due to the 100μF capacitor connected to its base. This capacitor can only discharge through Q7, since the associated 1N4002 diode is now reverse biased. During this discharge time, power is still applied to the circuit.

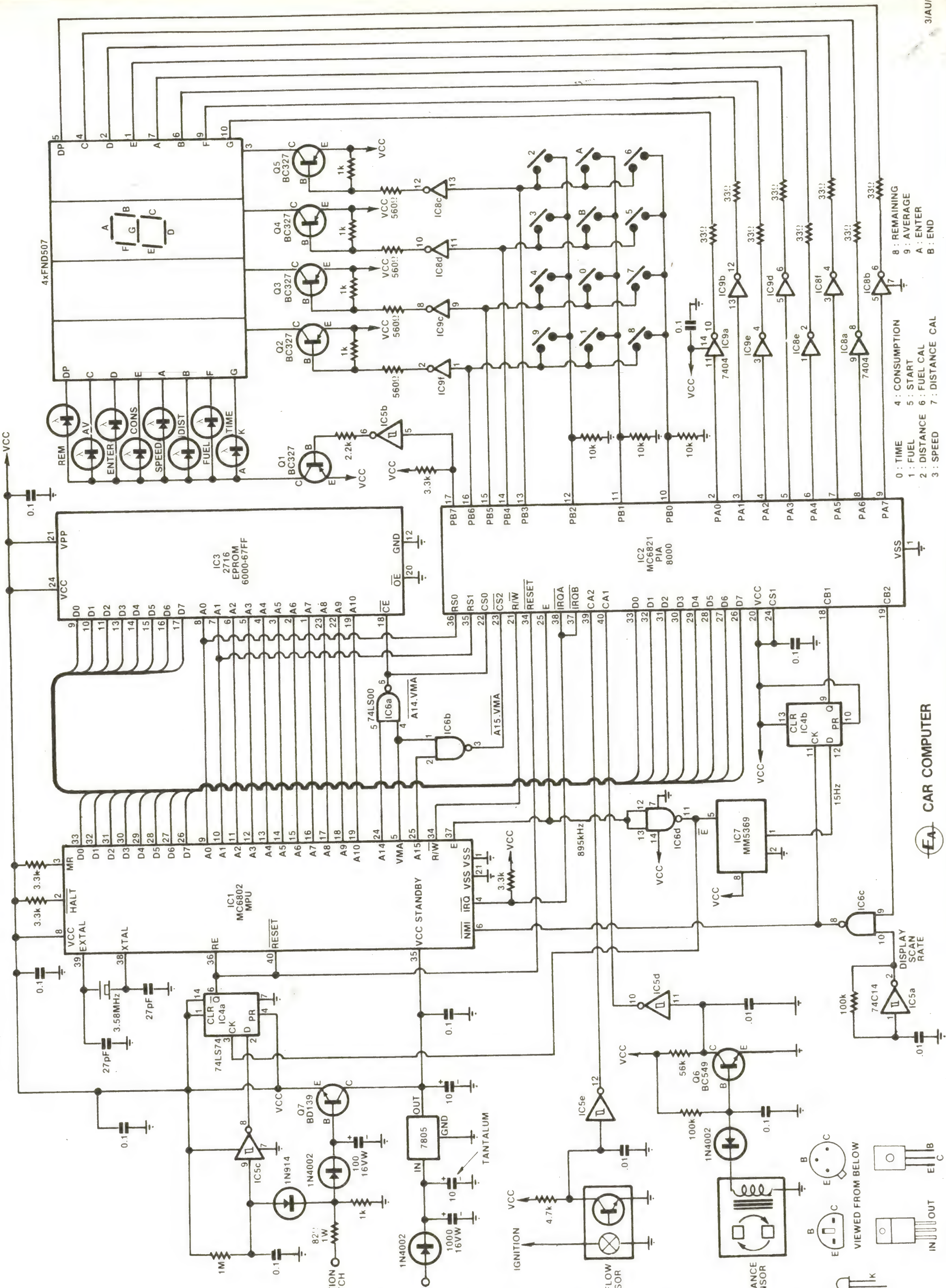
However, the 0.1μF capacitor at the input of IC5c is rapidly discharged at the moment of switch off via a series 1N4148 diode and 1kΩ resistor to ground. This sets the output of IC5c high and, at the next positive edge of the $\overline{\mathrm{E}}$ pulse (IC1, pin 37), both RE and $\overline{\mathrm{RESET}}$ go low.

This power down sequence ensures that memory in the first 32K bytes of RAM (which are permanently powered) is not corrupted at this critical stage.

The software

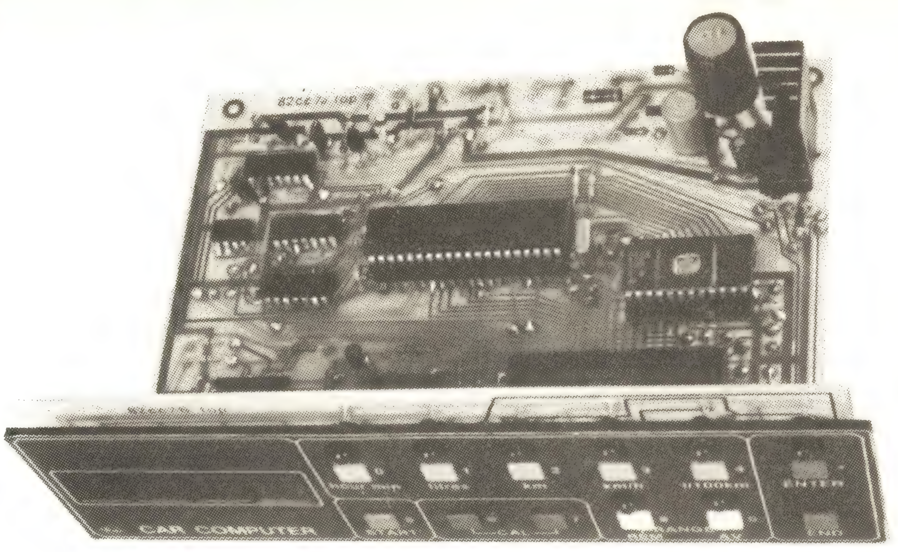
Although we do not intend to completely describe the software, flowcharts have been included to explain the basic concepts of the program. A few clarifying points, however, will help in tracing through these flowcharts.

As already mentioned, there are three programs for the Car Computer: RESET, Non Maskable Interrupt (NMI) and



EA CAR COMPUTER

CAR COMPUTER



Repeated from last month, this photograph shows the completed PCB assembly. IC sockets are mandatory for the three main ICs, optional for others.

Interrupt Request (IRQ). The "terminal point", shown in the key of symbols on Flowchart 1, starts off each program. Note that the RESET program has only a beginning and continues in a loop from then on. It is only the IRQ and NMI programs which return back to the RESET program after completion.

RESET program

Every one second, calculations are made for l/100km, km/h, km/h AV, hour.min REM, l/100km AV and km REM RANGE. Note that these calculations are made in this order, since some of them are interactive. For example, hour.min REM depends upon km/h AV while km REM RANGE relies upon l/100km AV.

All calculations involve division only. Multiplications are in factors of 10, in which case a simple left shift is all that is required. The necessary equations can be seen on Flowchart 1. Note that the l/100km calculation involves a × 10 rather than × 100 multiplication factor because the litre CAL is actually the number of pulses per 0.1 litres rather than per litre. Although the l/100km and km/h functions show equations involving multiplication, these are actually manipulated so that only divisions are carried out.

The two equations involving hour.min are actually more complex than shown since the minutes are converted to decimal hours in the case of the km/h AV calculation and from decimal hours to minutes in the hour.min REM calculation.

For those who are wondering how the data is handled, whether in binary or binary coded decimal (BCD), the answer is that all counting, with the exception of the time interrupt pulse counts, is in packed BCD. Consequently all data is stored in the BCD form and the actual division routine is performed in BCD.

Because all calculations are updated every second, regardless of the function displayed, changing from one function to another immediately provides an up-to-date calculation. At each of these one second updates, "Mask 2" is used to allow the program to skip over the 20ms key switch debounce time.

The remainder of the program is concerned with entering data, reading the key switches and initialising the PIA. Note that when entering the data, the far left-hand (most significant) digit is loaded with the first number pressed, the next digit to the right is loaded with the second number pressed, and so on. However, if four digits are not entered, upon pressing the END switch the whole display is shifted right until there are no blank displays to the right. The blanks now appear at the most significant side of the display.

Non Maskable Interrupt

We have already briefly described this routine, but the use of the Mask 1 has not been explained. Basically, this Mask prevents reading of the key switches. Previously, in the circuit description, it was mentioned that reading the key switches will clear the time $\overline{IRQB}$ and it is this we want to avoid if, when running the distance and fuel section of the IRQ program, $\overline{NMI}$ occurs. At the beginning of the fuel and distance IRQ routine, Mask 1 is set and is not cleared until this program is complete.

Interrupt Request

As mentioned previously, this routine updates the time, distance and fuel pulses and operates on these accordingly. Several important points should be made here. Firstly, decision logic in the time interrupt routine, titled "litres CAL small", decides whether the Moray fuel flow sensor or the Prince sensor is installed. Since the Moray sensor produces around 1500 pulses per 0.1 litres and the Prince sensor around 130, the program can easily determine which sensor is used by reading the entered calibration number. The logic then directs the program to count the fuel and distance pulses for the l/100km function over a one second period for the Moray sensor or over an eight second period for the Prince sensor.

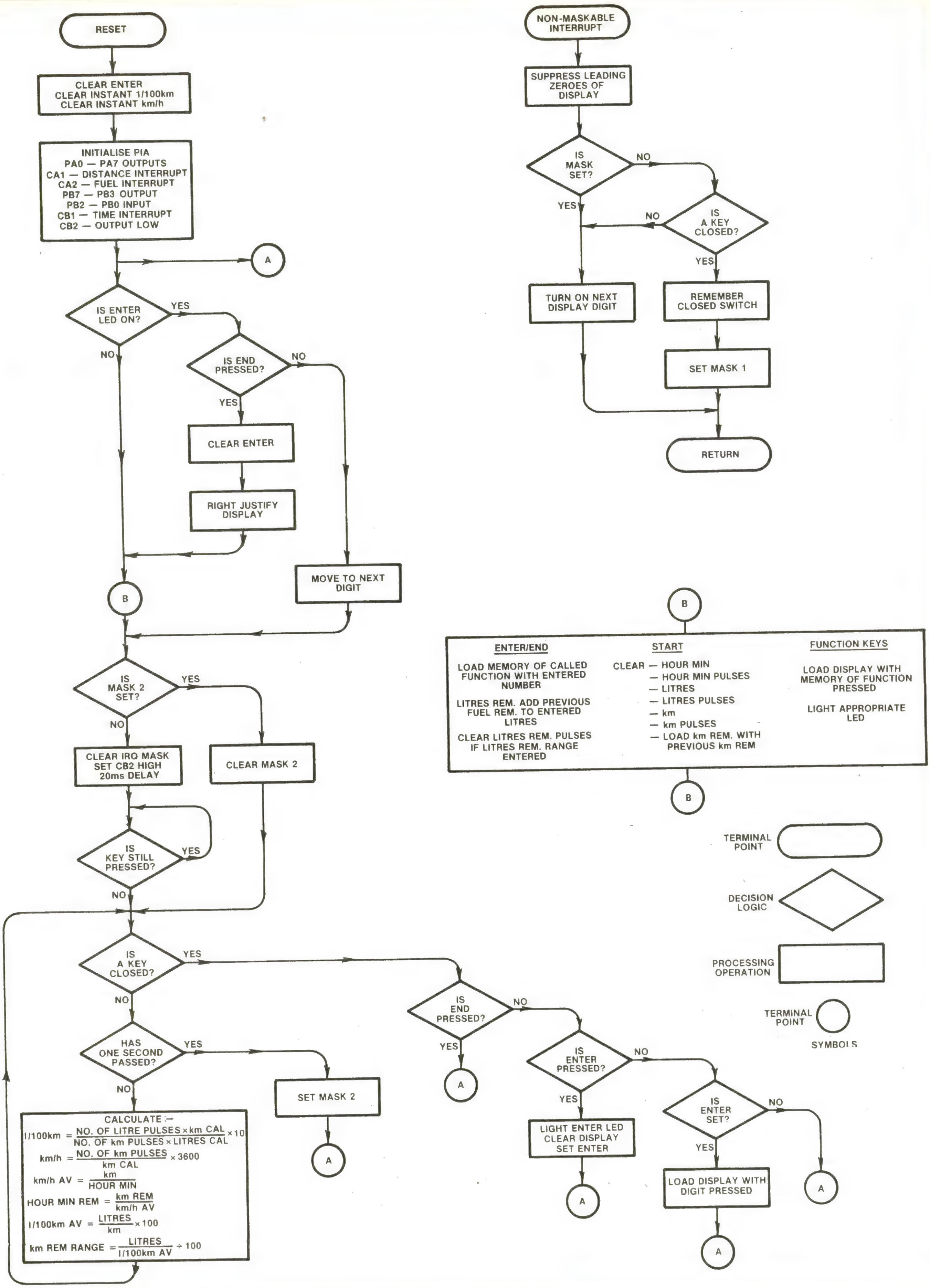
In other words, the instantaneous fuel consumption is updated once every one second if the Moray sensor is used, or once every eight seconds if the Prince sensor is used. (Clearly, the Moray sensor is the one to go for if you regard instantaneous fuel consumption as important.)

Note that the fuel flow pulse count is transferred to the latch memory at the end of each one second or eight second period, and the count memory cleared. When the subsequent l/100km calculation takes place, the latch memory is used to ensure that we have the correct number of pulses received during the count period. A similar method is also used for the km/h calculation; ie, the number of distance pulses counted over each second is transferred into the latch memory, and the count memory cleared ready to re-start counting the distance pulses.

The km and km REM functions also use a count memory for the distance covered. 1km is recorded when the number of km pulses equals the distance calibration (km CAL) number. The km pulses stored in the count memory are then cleared and allowed to re-start counting. The count memory is also cleared when the START key is pressed.

The litres and litres REM pulse count memories are separate. This is done because the litres pulse memory, which is cleared at the START of a journey, does not necessarily coincide with the filling of the tank.

Flowchart 1 (facing page) shows the RESET and NMI program routines, together with the calculations performed by the Car Computer. The NMI routine is used to update the display. ▶


RESET
CLEAR ENTER
CLEAR INSTANT 1/100km
CLEAR INSTANT km/h
INITIALISE PIA
PA0 — PA7 OUTPUTS
CA1 — DISTANCE INTERRUPT
CA2 — FUEL INTERRUPT
PB7 — PB3 OUTPUT
PB2 — PB0 INPUT
CB1 — TIME INTERRUPT
CB2 — OUTPUT LOW
A
IS ENTER LED ON?
YES
NO
IS END PRESSED?
NO
YES
CLEAR ENTER
RIGHT JUSTIFY DISPLAY
MOVE TO NEXT DIGIT
B
IS MASK 2 SET?
YES
NO
CLEAR IRQ MASK
SET CB2 HIGH
20ms DELAY
CLEAR MASK 2
IS KEY STILL PRESSED?
YES
NO
IS A KEY CLOSED?
YES
NO
HAS ONE SECOND PASSED?
YES
NO
SET MASK 2
A
CALCULATE :—
l/100km = NO. OF LITRE PULSES × km CAL / NO. OF km PULSES × LITRES CAL × 10
km/h = NO. OF km PULSES / km CAL × 3600
km/h AV = km / HOUR MIN
HOUR MIN REM = km REM / km/h AV
l/100km AV = LITRES / km × 100
km REM RANGE = LITRES / l/100km AV ÷ 100
IS END PRESSED?
NO
YES
A
IS ENTER PRESSED?
NO
YES
LIGHT ENTER LED
CLEAR DISPLAY
SET ENTER
A
IS ENTER SET?
NO
YES
LOAD DISPLAY WITH DIGIT PRESSED
A
A
NON-MASKABLE INTERRUPT
SUPPRESS LEADING ZEROES OF DISPLAY
IS MASK SET?
NO
YES
IS A KEY CLOSED?
NO
YES
TURN ON NEXT DISPLAY DIGIT
REMEMBER CLOSED SWITCH
SET MASK 1
RETURN
B
ENTER/END
LOAD MEMORY OF CALLED FUNCTION WITH ENTERED NUMBER
LITRES REM. ADD PREVIOUS FUEL REM. TO ENTERED LITRES
CLEAR LITRES REM. PULSES IF LITRES REM. RANGE ENTERED
START
CLEAR — HOUR MIN
— HOUR MIN PULSES
— LITRES
— LITRES PULSES
— km
— km PULSES
— LOAD km REM. WITH PREVIOUS km REM
FUNCTION KEYS
LOAD DISPLAY WITH MEMORY OF FUNCTION PRESSED
LIGHT APPROPRIATE LED
B
TERMINAL POINT
DECISION LOGIC
PROCESSING OPERATION
TERMINAL POINT
SYMBOLS

YOUR BONUS-JAYCAR

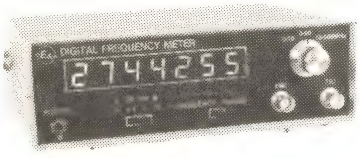
500MHz Digital Frequency Period Meter

REF: EA Dec '81 – Feb '82

NOW BACK IN STOCK! The best version of this kit in Australia is now back in stock. Why settle for an inferior kit at the same price as ours?

500MHz option only $26 extra

50MHz Version $119



ONLY $119

Tilting Bail to suit ONLY $4.95

Other people may appear to be selling this kit for less. But you GET less!!! Exclusive Jaycar features:
* Heavy gauge front panel. Pre-punched, and silkscreened. (NOT Scotchcal). * Low aging rate 10.000 MHz crystal * Quality IC sockets provided (A MUST) * All metal film resistors used (1% 50ppm) *Thermalloy heatsink for +5V regulator

Beware of advertised units that do not conform to the original design. They may have inferior performance.

THE BEST QUALITY KIT VERSION OF THIS PROJECT IN AUSTRALIA

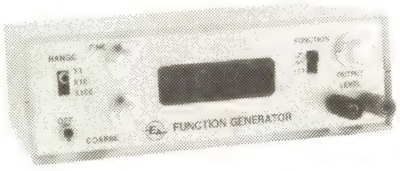
* * *

Function Generator

Ref: EA April 1982

"Pigeon Pair" companion to the new 500MHz DFM. Low distortion generator of sine, square and triangular waveforms. From below 20Hz to over 160kHz. Inbuilt 4 digit frequency counter in de-luxe Pac-Tec case. Only $85

JAYCAR EXCLUSIVE – 1% 50ppm metal film resistors used for stability and it's still only $85!!!



Unit pictured with EA Panel

Only $85

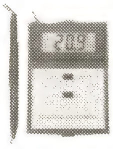
SPECIAL JAYCAR PANEL SUPPLIED

EXCLUSIVE!!! ALL JAYCAR TEST EQUIPMENT KITS ARE PROVIDED WITH QUALITY I.C. SOCKETS AT NO EXTRA CHARGE!!!

Digital EA2/82 Thermometer

Ref: EA Feb 1982

Read the temperature in your room (or outside) from 0 degrees C to 100 degrees C in fact to with in 0,1 degree C. Fantastic resolution on a bright easy-to-read display. INC CASE

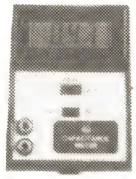


$69

DIGITAL CAPACITANCE METER

Ref: EA March 1982

This kit once again uses the amazing DPM 200 LCD display/driver module Capable of measuring capacitance from 1pF to 19.99uF. It is a must in every workshop or lab. Kit includes case.

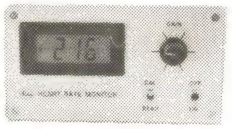


$69

HEART RATE MONITOR

Ref: EA 7/82

NEW

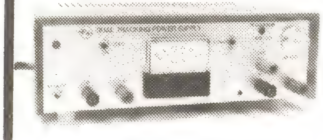


ONLY $79

This unit enables you to measure your own pulse instantly and accurately. It is light enough even for joggers to carry. A must for people who may have heart problems. Complete kit including LCD Display.

EA dual tracking P/S

EXCLUSIVE!! US–MADE 10 TURN .25% LINEARITY POT used for greater accuracy



$84.50

Ref: EA March '82

1% resistors used NOT 2%.

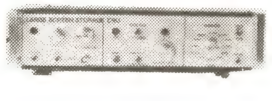
At last!! A dual-tracking power supply with fixed +5V reg. at a reasonable price!!

YOU PAY NO MORE FOR A QUALITY JAYCAR KIT!!

Digital Storage CRO Adaptor

Ref: Feb 1982 EA

Not only can you avoid buying an expensive CRO but you can have the features of the REALLY expensive ones!!!



$110

- Can display very slow waveforms
- One shot triggering
- Inbuilt graticle shows on TV screen
- Crystal locked timebase
- DC-100kHz bandwidth
- capable of storage operation

Staggering value at $110.

NEW!!! LCD TACHO KIT!

ref: EA May 1982

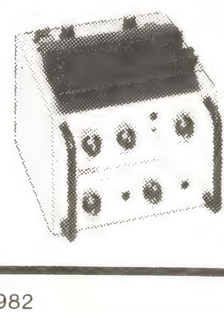
$49.50

- USES NEW DPM–05 DISPLAY
- FITS INTO YOUR DASHBOARD
- RPM, DWELL DISPLAY

ETI 480 AMP-COMPLETE -closeout price

You benefit from our new low price for this legendary 100W Guitar/P.A.
- 100W RMS into 4 ohms 60W/85 ohms.
- Completely self contained.
- Includes power supply and rugged 16 gauge aluminium case.
- Line input drives to full power.
- Can accommodate 480 preamp.

(2 input mic/guitar, Bass Treble, separate level controls, master level control) in the same case. (Preamp only $30 extra). We only have a few left so grab one now at only $99.



$99 was $130

GOOD-BYE 3002

This 2x300WRMS P.A. Head is a classic road amp. Ruggedly constructed, 19" rack mount makes an ideal main P.A. or foldback unit. Great for Disco use as well.

We are discontinuing this amp because it is becoming too expensive to make. The metalwork costs alone now account for well over 50% of the unit. Because of this we have reluctantly decided to discontinue the unit.
You can grab one now while they last for only $399

SAVE $89!!!

~~$489~~ $399

Send SAE for full spec. sheet.

QUALITY FOR NO MORE

Lyrebird Piano Kit REF: EA 11/81-1/82

NEW LOW PRICE...

$475

SAVE $50!!!

BOTH PIANO KITS FEATURE I.C. SOCKETS PROVIDED AT NO EXTRA CHARGE!!!

Because we are shipping keyboards and other expensive components in bulk due to high demand, we can pass savings onto YOU.
You can now have a magnificent "Lyrebird" six octave touch sensitive piano for only $475!! That's a staggering $50 off the old price.
REMEMBER!! THE LYREBIRD OUTPERFORMS READY BUILT PIANOS COSTING UP TO THOUSANDS OF DOLLARS MORE. WHY PAY MORE WHEN YOUR CONSTRUCTION KNOWLEDGE CAN SAVE YOU A FORTUNE?

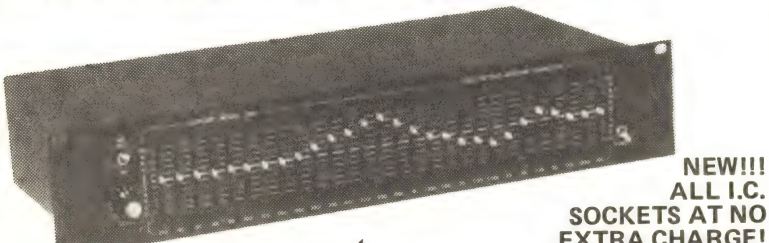
7¼ OCTAVE (88 NOTE) VERSIONS **$589** * Stand $75 extra

EPROM PROGRAMMER

only $59

Ref:
EA Jan 1982
This versatile kit enables you to program the popular EPROMS, WITHOUT a computer!!! Includes 24 pin socket. Zero insertion force socket to suit, ONLY $12.50

1/3 OCTAVE GRAPHIC EQUALISER



NEW!!! ALL I.C. SOCKETS AT NO EXTRA CHARGE!

ONLY $198

The 2801 is a single channel graphic equaliser that divides the audio spectrum into twenty eight one third octave bands. Each frequency segment is controlled by a slider that provides up to – 10dB of adjustment in standard ISO steps. The 2801 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality.
In P.A. application the equaliser may be used to improve sound quality and increase intelligibility by attenuating problem frequencies that cause ringing, boominess or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be "tuned" according to the special acoustics of a room, to maximize output and minimize feedback.
As a creative tool in sound recording or re-recording the 2801 allows complete freedom in contouring response over the complete audio spectrum from 31.5Hz to 16KHz.

SPECIFICATIONS

DISTORTION (@ 2 volts out)	Less than .04% 20Hz–20kHz
FREQUENCY RESPONSE	
–EQ. OUT	Flat
–EQ. IN	20Hz–20kHz ±½dB
SIGNAL TO NOISE RATIO (@ 2 volts out, controls flat)	Greater than 85dB
OUTPUT IMPEDANCE	50k to 100k depending on the input configuration
MAXIMUM INPUT VOLTAGE	10 volts
EQ centre frequencies	31.5, 40, 50, 63, 80, 100, 120, 160, 200, 250, 315 400, 500, 630, 800, 1K, 1.25K, 1.6K, 2K, 2.5K, 3.15K, 4K, 5K, 6.3K, 8K, 10K, 12.5K, 16K, Hz
Range of controls	
Individual Filters	±10dB
Level	±15dB
CONTROLS	
EQUALISATION	28 Vertical potentiometers continuously variable ±10dB
LEVEL	Rotary potentiometer variable ±15dB
EQ. BYPASS	Toggle switch
POWER	Toggle switch
Terminations	Rear panel RCA sockets and 6.5mm sockets for input and output
PHYSICAL	
Size	19" x 3½" x 8" (standard rack mount size)
Weight	4kg
Finish	Front panel brushed and anodised black with lettering, black Marviplate cover.

TOTALLY REFURBISHED MODEL–2801 MKII A

This model is distinct from the 2801, 2801 MK II. It features quality I.C. sockets for all I.C.'s as well as several component changes. ie: We are using 4136 op amps again because they draw less current than the TLO75/85. This results in less hum radiation from the transformer. We are also using higher value slide pots, and a 5534 op amp for the line driver. Using the 5534 renders the output short circuit proof-handy whenon the road.
You get all these great new features at no extra cost!

2010 MK II

ONLY $129

The 2010 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to = 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of adjustment of = 14dB. The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel. Included amoungst these are the ability to equalise both recording and playback when dubbing tapes. The 2010 has been designed to be compatible with all commercially available equipment and is ideal for use in a Hi Fi system or PA system

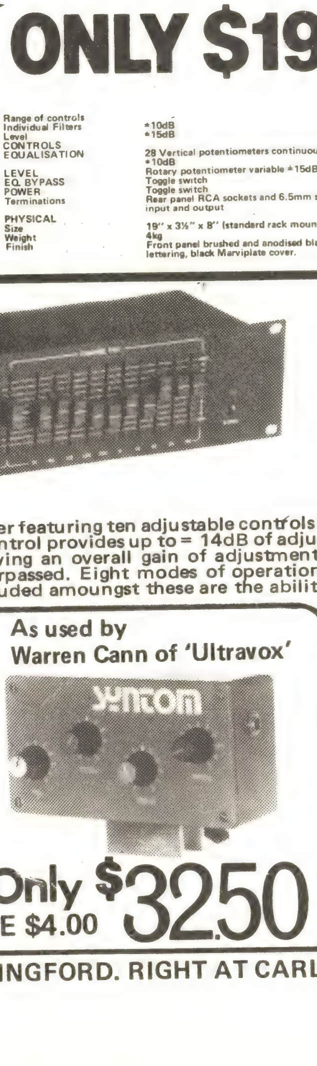
SPECIFICATIONS

ELECTRICAL (EACH CHANNEL)	
FREQUENCY RESPONSE	
F.Q. LINE OR TAPE	±0.5dB 10Hz to 20kHz, Controls flat
EQ BYPASS	Flat
SIGNAL TO NOISE RATIO	
2 VOLTS OUT CONTROLS FLAT	Greater than 87dB
TOTAL HARMONIC DISTORTION	
1 VOLTS OUT CONTROLS FLAT	Less than .04 % 20Hz to 20kHz
OUTPUT IMPEDANCE	100ohms
RATED OUTPUT	2 Volts RMS into 10K load
OUTPUT AT CLIPPING	10 volts RMS
INPUT IMPEDANCE	50K nominal
MAXIMUM INPUT VOLTAGE	10 volts RMS
EQ CENTRE FREQUENCIES	31, 62, 125, 500, 1K, 2K, 4K, 8K, Hz±10%
RANGE OF CONTROLS	
INDIVIDUAL FILTERS	±12 dB at Centre Frequency
LEVEL MATCH	±10dB
CONTROLS	
EQUALISATION	10 Vertical Slide Controls for each channel
LEVEL	Vertical Slide Control each Channel
EQ BYPASS	Pushbutton Switch
EQ LINE	Pushbutton Switch
EQ TAPE	Pushbutton Switch
MONITOR TAPE	Pushbutton Switch
POWER	Pushbutton Switch withLED indicator
TERMINATIONS	Rear panel RCA sockets for both input and output connections
PHYSICAL	
DIMENSIONS	483mm x 89mm x 152mm (19"x 3½"x 8")
WEIGHT	4kg
FINISH	Front panel brushed and anodised Aluminium silk screened lettering. Black Marviplate covers.

syntom

Original design from the UK magazine "Electronics and Music Maker" April 1981. Self-contained unit produces a variety of fixed and falling pitch effects. Trigger by tapping the unit itself or by striking a drum to which the unit is attached. The Jaycar "SYNTOM" comes complete with high quality pre-drilled moulded all ABS box 152 x 80 x 47mm with professional silk-screened front panel.
FEATURES: Decay from less than 0.1 second to several seconds, pitch control, sweep control and volume on/off.

As used by
Warren Cann of 'Ultravox'



Only $32.50

THIS MONTH ONLY!! SAVE $4.00

Jaycar

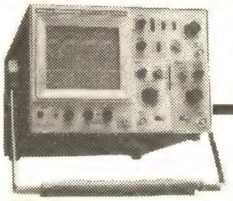
125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293
Mail Orders To:
Box K-39 Haymarket 2000

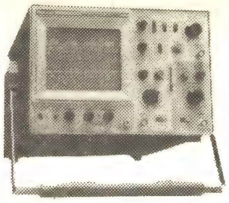
NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Post and Packing charges
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

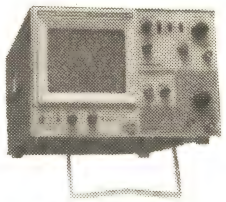
OPENING NEXT MONTH AT CARLINGFORD. RIGHT AT CARLINGFORD COURT, NEXT TO KENTUCKY FRIED CHICKEN.

A NEW WAVE IS ON THE HORIZON





- 15 MHz
- 20 MHz
- 30 MHz



National

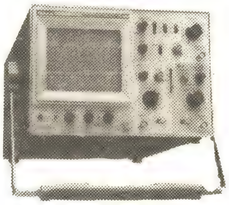
Probes supplied as standard accessory

. . . FROM $389.00 (not including sales tax)

Available in four models VP-5215A, VP-5216A, VP-5220A and VP-5231A
— these low cost oscilloscopes feature:

- 1 mV/Div sensitivity
- Stable automatic trigger 'AUTO FIX'
- Full range of triggering mode
- Bright and sharp CRT with Auto Fix
- TV(V) and TV(H) sync separator circuit
- Rectangular tube, illuminated internal graticule (VP-522OA and VP-5231A)
- Built-in delay line for observation of pulse transient (VP-5231A only)
- High reliability — MTBF 15,000 hours

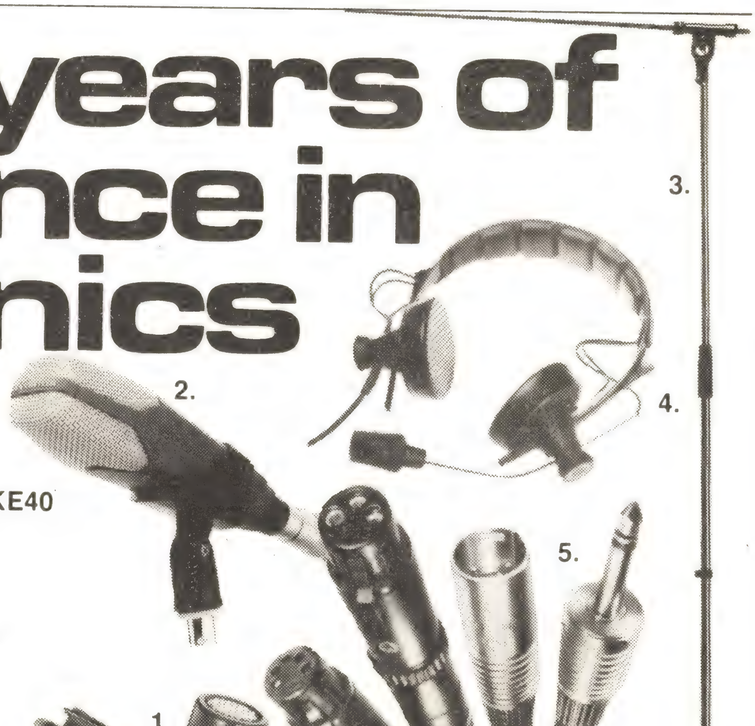
National have a wide range of scopes — to 300 MHz. Please call or write for further information.



SCIENTIFIC DEVICES AUSTRALIA PTY LTD
2 JACKS ROAD, SOUTH OAKLEIGH, VICTORIA, 3167. PHONE: 579 3622.
31 HALSEY ROAD, ELIZABETH EAST, S.A., 5112. PHONE: 255-6575
35-37 HUME STREET, CROWS NEST, N.S.W., 2065. PHONE: 43-5015

bankcard
welcome here

buy 30 years of experience in electronics



R.H. Cunningham suppliers and innovators in the audio and broadcasting product field, have the professional expertise in both the technical and service areas to support the products they sell.

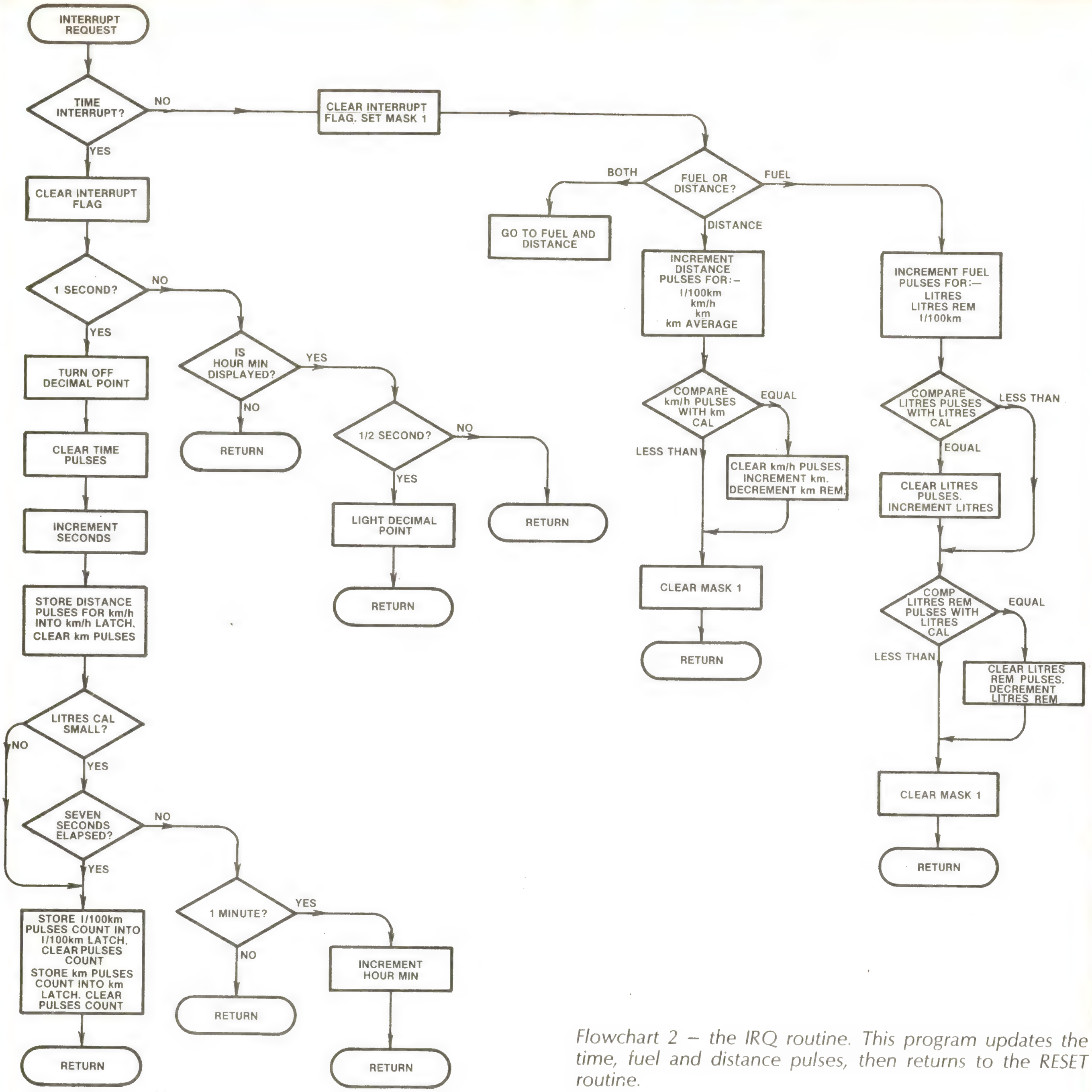
1. SENNHEISER directional lavalier microphone MKE40
2. SENNHEISER high quality directional studio microphone MD 419
3. König and Meyer music and microphone stands and accessories
4. SENNHEISER HMD 414X microphone/headphone combination
5. Neutrik Modular audio connectors

All of the above products are available from

R.H.Cunningham
PTY.LTD.

146 Roden St., West Melbourne, Vic. 3003. Tel. 329 9633. Telex 31447.
4-8 Waters Rd., Neutral Bay, NSW. 2089. Tel. 909 2388. Telex 21707.

RHC 014


INTERRUPT REQUEST
TIME INTERRUPT?
NO
YES
CLEAR INTERRUPT FLAG. SET MASK 1
CLEAR INTERRUPT FLAG
FUEL OR DISTANCE?
BOTH
FUEL
DISTANCE
GO TO FUEL AND DISTANCE
INCREMENT DISTANCE PULSES FOR:— l/100km km/h km km AVERAGE
INCREMENT FUEL PULSES FOR:— LITRES LITRES REM l/100km
1 SECOND?
NO
YES
IS HOUR MIN DISPLAYED?
YES
NO
TURN OFF DECIMAL POINT
CLEAR TIME PULSES
RETURN
1/2 SECOND?
NO
YES
INCREMENT SECONDS
LIGHT DECIMAL POINT
RETURN
RETURN
STORE DISTANCE PULSES FOR km/h INTO km/h LATCH. CLEAR km PULSES
COMPARE km/h PULSES WITH km CAL
EQUAL
LESS THAN
CLEAR km/h PULSES. INCREMENT km. DECREMENT km REM.
CLEAR MASK 1
RETURN
COMPARE LITRES PULSES WITH LITRES CAL
LESS THAN
EQUAL
CLEAR LITRES PULSES. INCREMENT LITRES
COMP LITRES REM PULSES WITH LITRES CAL
EQUAL
LESS THAN
CLEAR LITRES REM PULSES. DECREMENT LITRES REM
CLEAR MASK 1
RETURN
LITRES CAL SMALL?
NO
YES
SEVEN SECONDS ELAPSED?
NO
YES
1 MINUTE?
YES
NO
STORE l/100km PULSES COUNT INTO l/100km LATCH. CLEAR PULSES COUNT STORE km PULSES COUNT INTO km LATCH. CLEAR PULSES COUNT
INCREMENT HOUR MIN
RETURN
RETURN
RETURN

Flowchart 2 – the IRQ routine. This program updates the time, fuel and distance pulses, then returns to the RESET routine.

Construction

Fortunately, construction of the EA Car Computer is a lot easier than understanding how it works. All the circuitry is accommodated on two double-sided printed circuit boards (PCBs) which are soldered together at right angles to virtually eliminate internal wiring. The completed PCB assembly is mounted in a standard Pac-tec case and fitted with a silver-on-black front panel that should mate well with the interior of most modern cars.

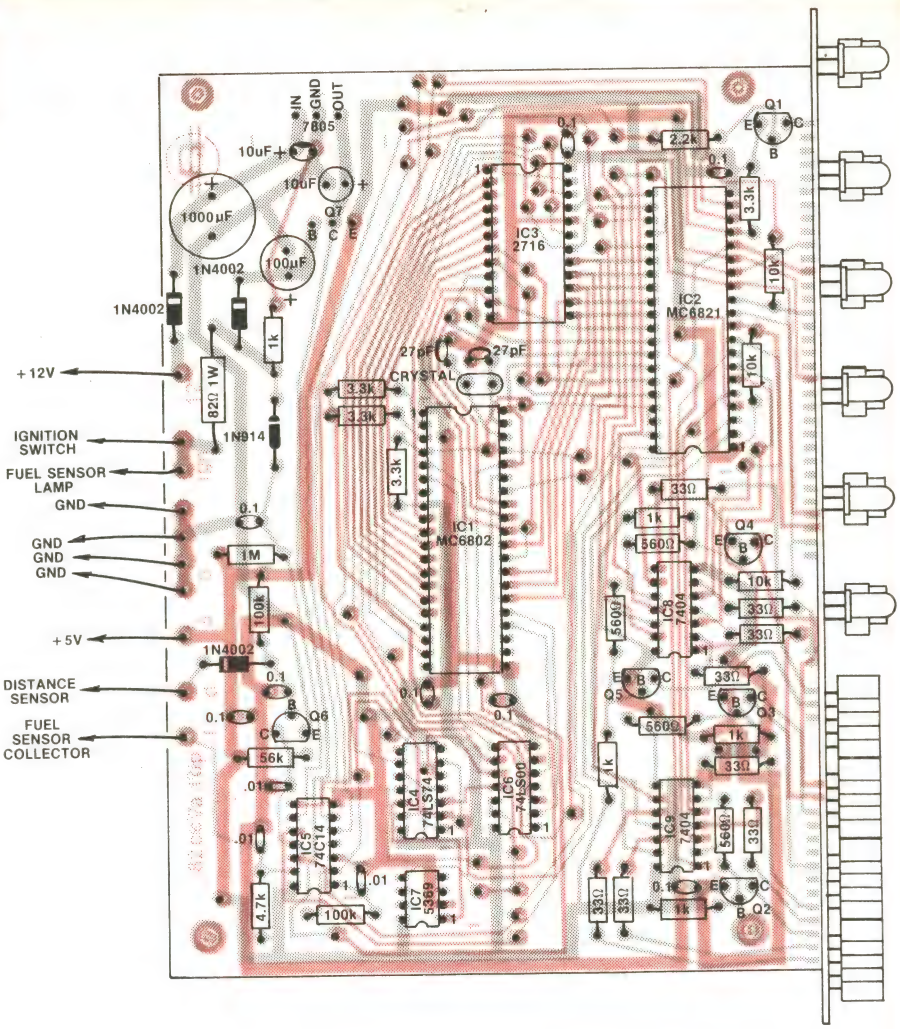
We understand that PCBs with plated-through holes will be available for this project, and these are well worthwhile as they simplify construction considerably. If the holes are not plated-through, you will have to solder the pads on the component sides of the PCBs as well as on the reverse sides. In this case, components such as IC sockets (wire-wrap type) and capacitors will have to sit slightly proud of the PCB so that you can gain access to the leads.

In addition, if the holes are not plated-through, you will have to insert and solder a large number of pin-throughs. These pin-throughs consist simply of a short length of tinned copper wire soldered in and then cropped close to the board. They must be inserted first, since some are beneath ICs.

Before starting construction, very carefully inspect the two PCBs for possible shorts between tracks or breaks in the copper pattern. A few minutes careful checking here could save a lot of frustration later on. Check also that the edge bus on the main PCB runs right up to the edge; if not, file the edge until it does.

The way in which it all goes together is fairly obvious from the photographs and diagrams. Start by assembling the main PCB (code 82cc7a, 171 x 123mm) according to the parts overlay diagram, making sure that all polarised components are correctly oriented. These include the ICs, transistors,

CAR COMPUTER



Parts layout diagram for the main PCB. Don't forget to solder on both sides of the board if the holes are not plated through (see text).

diodes, electrolytic capacitors, and the three terminal regulator.

The use of IC sockets is mandatory for IC1, IC2 and IC3, and optional for the remaining ICs. Use wire-wrap sockets if the board is not plated through. Wire-wrap sockets have longer (and stronger) pins than normal types, and can be easily mounted proud of the PCB so that the appropriate pins can be soldered on both sides. You'll need a soldering iron with a small pointed tip for this work.

IC5 (74C14) is a CMOS device, so the usual precautions should be observed to prevent damage from static electricity. If you elect to solder it, earth the barrel of your soldering iron to the earth track on the PCB and solder pins 7 and 14 first. It is also a good idea to place a small piece of opaque tape over the EPROM window if this has not already been done.

A small clip-on heatsink, Thermaloy 6038 or equivalent, is required for the 7805 three-terminal regulator which normally runs quite hot. The heatsink simply clips over the regulator and the lugs inserted through holes in the PCB and bent over.

We used PC stakes to facilitate connections to the rear panel socket.

With assembly of the main board complete, attention can be turned to the display board and front panel assembly. The display board is coded 82cc7b, measures 191 x 57mm and accommodates the LED readouts, the eight indicator LEDs, and the 12 key switches.

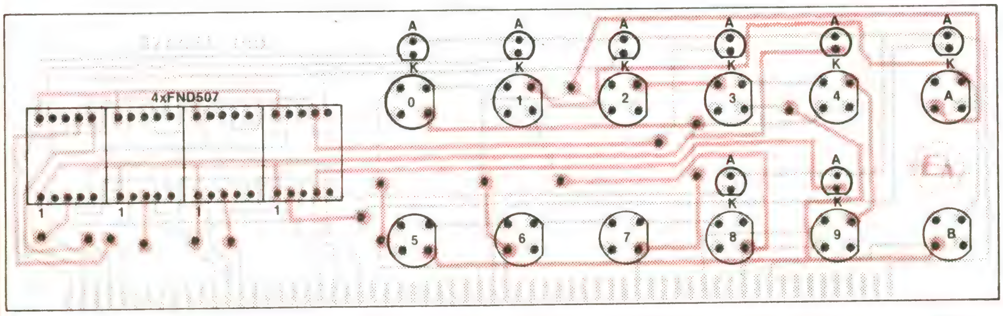
Begin by soldering in the key switches according to the parts overlay diagram. The switches are mounted flush with the PCB and the appropriate pins soldered on both sides if the holes are not plated through. Use blue switches for positions 0 to 4, red for START, ENTER and END, green for positions 6 and 7, and white for positions 8 and 9.

The four FND507 LED displays are next and must be oriented so that the ribbed edge of each display is at the top. The displays are not mounted flush but stood off the PCB so that they will line up properly with the switches and front panel. Perhaps the best way of locating the displays off the PCB is to use a strip of cardboard 1.5mm thick, 10mm wide and at least 65mm long. Temporarily insert this beneath the displays, push the displays in as far as they will go, and solder.

As with the key switches, some of the pins will have to be soldered on both sides of the PCB if the holes are not plated through.

Note that although the circuit shows 13mm FND507 displays, you can also use the recently released 15mm Stanley "super bright" displays. Unlike the FND507s, however, the Stanley displays do not have an integral plastic filter. They will have to be mounted flush against the board, and a suitable filter inset into the cutout. You will also have to make the cutout slightly larger.

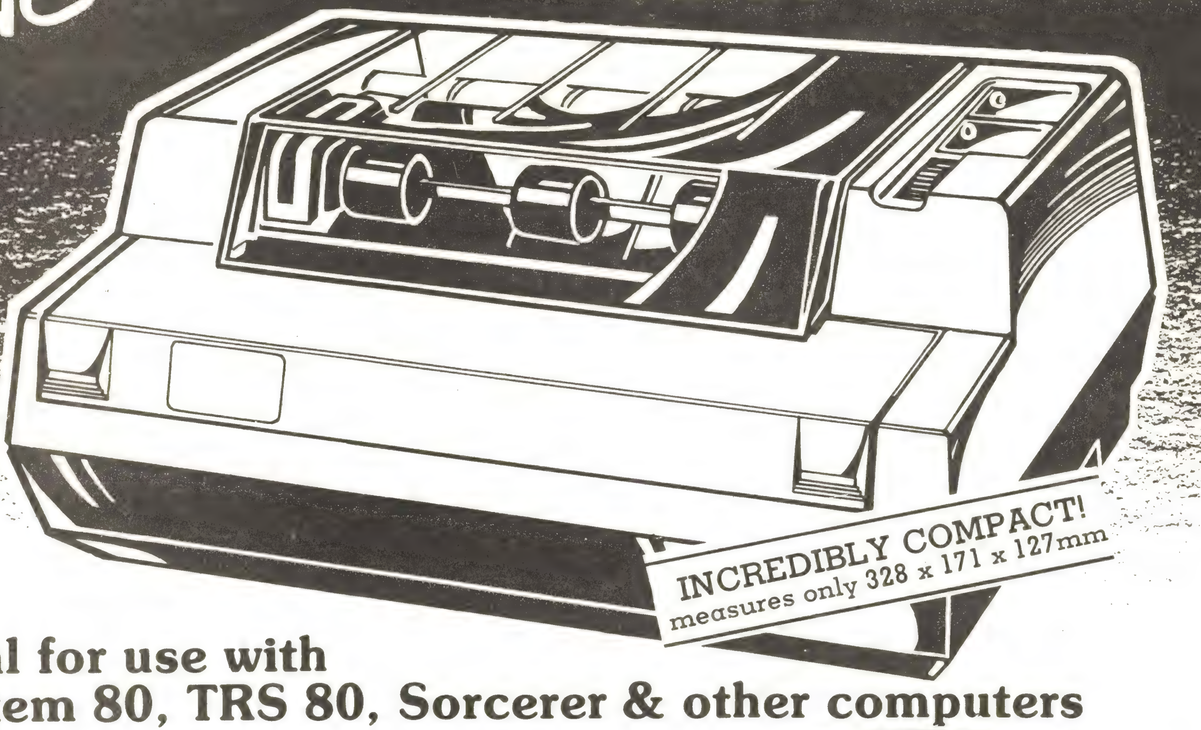
Stanley displays are distributed by A&R Soanar and are available in three colours: NKR163 red, NKG163 green, and NKY163 yellow. Note that, in this



Left: parts overlay diagram for the display PCB. Make sure that you mount the four FND507 displays the right way up.

Dot Matrix Printer save nearly $100!

who else but DICK SMITH could offer value like this?



INCREDIBLY COMPACT!
measures only 328 x 171 x 127mm

Ideal for use with System 80, TRS 80, Sorcerer & other computers

Up until now you would expect to pay around $1,000 for a dot matrix printer. We've changed all that with the release of this compact 80 column tractor-feed impact printer.

ONLY
$399
SAVE NEARLY $100!

look at these features:

- Full 80-column printing
- Tractor-feed as standard
- Printing at 30 characters/second
- High-resolution graphics printing
- Standard Centronics-type parallel interface
- Compact size: only 328 x 171 x 127mm

WAS ~~$495~~!

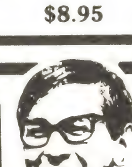
Cat. X-3252

Optional cable required for connection of printer to computer. Type depends on computer.

OUR MOST POPULAR PRINTER EVER!

Item	Cat.	Price
Fan Form Paper 2,000 sheets continuous fan form paper to suit printer	Cat. X-3254	$27.50
Replacement Ribbons	Cat. X-3253	$8.95

DICK SMITH Electronics
See Page 124 for address details



DSE/A181M/PAI

PROTECT YOUR COMPUTER AGAINST BREAKDOWN

Computer Country now offers a special insurance policy to protect you.

You can insure against accidental damage and breakdown of your computer and your software. For an annual premium of $135, David Hornidge Insurances will arrange insurance on a computer system worth up to $10,000 against accidental damage and breakdown.

You are covered against
ACCIDENTAL DAMAGE
which means unforseen loss or damage to your computer from any cause other than breakdown.

You are covered against
BREAKDOWN
which means the actual breaking, distortion or electrical burning out of any part whilst in use arising from a defect in your computer causing sudden stoppage of its function and requiring its repair or replacement.

You are covered for
REINSTATEMENT
which means in the event of a total loss: "New for Old"; in the event of damage: the full cost of repair, or if the necessary replacement parts are unobtainable, the full cost of equivalent repair of similar modern equipment.

You are covered for
EXTRA REPAIR COSTS
which means additional costs approved by the insurance company for temporary repairs for an amount up to $1,000 or 50% of the cost of normal repair, whichever is the less.

This is only a summary of the covers available under the policy. It should be noted that all covers are subject to the terms, conditions, exceptions and limitations of the policy. a copy of which will be made available at your request.

The policy covers:

Central processor, storage devices, central console, power pack, disc drives, tape transports and peripheral equipment. For example:-
readers, printers, output punches etc.

Some exceptions are:-

* Nuclear Radiation * Nuclear Explosion * Derangement * War Risks * Wear and Tear * Sonic Bangs * Costs recoverable under other agreements or warranties.

EXCESS - Please note, there is an excess clause in this policy which means that the first $100 of each and every claim must be paid by the insured.

QUESTIONAIRE

Please answer **YES/NO** where appropriate by 'X' in Box

1. Has any Insurance Company
   a) Declined to insure you? **YES** ( ) **NO** ( )
   b) Cancelled or refused to renew your insurance? **YES** ( ) **NO** ( )
   c) Required special terms to insure you? **YES** ( ) **NO** ( )

If **YES** to any questions please give full details:-

2. Have you made a claim or suffered any losses in the last 3 years? **YES** ( ) **NO** ( )
   If **YES**, please give details:-
3. Are there any other important matters relating to the risk to be insured against which you should disclose to enable the Insurance Company to decide whether your Proposal Form will be accepted? **YES** ( ) **NO** ( )

IMPORTANT:- A proposer for insurance is required by law to give full and complete answers to all questions in the Proposal Form and disclose any other material information related thereto. Failure to do so entitles the Insurance Company to avoid the policy.

I/We hereby warrant and declare the truth of all the above statements, and I/We hereby agree that this Proposal and Declaration shall be the basis of the Contract between myself/ourselves and the insurance company.

I/We agree to accept the Terms, Exceptions, Conditions and Limitations of the policy.

SIGNATURE OF PROPOSER(S) ....

Date / /19

COMPLETE THE PROPOSAL FORM AND SIGN THE QUESTIONAIRE. TEAR OFF THE COUPON AND SEND IT TOGETHER WITH YOUR CHEQUE FOR $135 TO:

DAVID HORNIDGE INSURANCES PTY. LTD.
422 COLLINS STREET,
MELBOURNE: VIC. 3000
Telephone: (03) 67 8583

COMPUTER PROPOSAL FORM

Insured's Name: .... **Telephone:** ....
Insured's Address: ....
.... **Postcode:** ....
Business: ....
Situation: ....
Period of Insurance from / / **to** / /
SUM INSURED $
PROPERTY INSURED:
Computer -
Maker's Name ....
Date of Make ....
Type/Model Number ....
Total New Replacement Value $ ....

N.B.
No insurance is in force until the Proposal Form and the Premium have been accepted by David Hornidge Insurances Pty. Ltd., who reserve the right to decline cover or to impose terms.

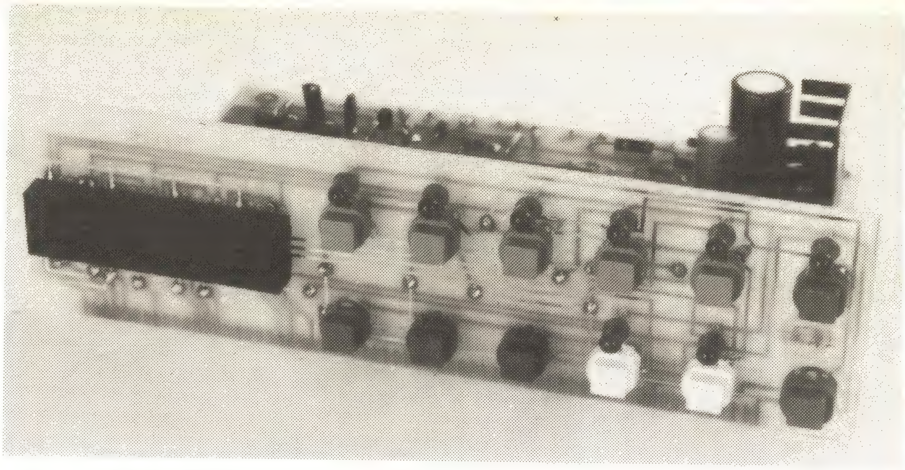
application, they can only be used with a plated-through PCB.

The Scotchcal label should now be carefully affixed to the smooth side of the front panel, and holes drilled and filed to shape to take the displays, LEDs and switches. Proceed carefully with this step, periodically offering the front panel to the display board so that you can judge how much progress has been made. The job is admittedly tedious, but requires care to ensure a neat finish.

In some kits, however, this work will not be necessary. At least one retailer will be supplying silk-screened and pre-punched front panels to ensure a "snazzy" job!

At this point, mount the LED bezels on the front panel and snap the eight LEDs into position. Orient the LEDs so that the anode leads are at the top, then insert all the LED leads through their respective mounting holes by carefully offering the front panel to the display PCB. Position the front panel so that it sits flush with the front surface of the seven-segment displays, then solder each LED in turn.

Check that all switches operate correctly and make any necessary adjustments before trimming the LED leads. The switches should sit about 1.5mm proud of the front panel.



View showing the display PCB assembly before fitting the front panel. Note that the FND507 displays are mounted proud of the board (see text).

As before, you will have to solder both sides of the PCB if the holes are not plated through. Install the LEDs as described above, then remove the front panel (by pushing the LEDs out of the bezels) to gain access to the two pads on the component side. Re-install the front panel when you have finished soldering.

The display PCB can now be soldered to the main PCB. To do this, slide the front panel/display PCB assembly into the retaining slot at the front of the case, and screw the main PCB to the four moulded standoffs on the base. Check that the two edge buses line up, then solder the six mating bus pads together. This done, remove the PCB assembly from the case and solder the bus pads on the reverse side.

With assembly of the PCBs complete, go over your work and check that all components are in the correct position and that all the pads have been soldered. Before actually inserting the three main ICs into their sockets, it is best to check voltages around the circuit.

Apply between 10 and 15 volts DC to the +12V and ignition terminals, and check the supply voltages on all ICs and IC sockets with a multimeter. If all is correct, disconnect power and insert the ICs. When power is reconnected the word "rEdY" should appear if the START switch is pressed. Pressing other buttons should turn on the appropriate indicator LED and bring up various numbers on the display.

Next month, we will tell you how to fit the sensors to the vehicle and describe how the Car Computer is operated.

PARTS LIST

1 Pac-tec case, 205 x 159 x 65mm
1 double-sided PCB, code 82cc7a, 171 x 123mm
1 double-sided PCB, code 82cc7b, 191 x 57mm
1 12-way Utilux line plug socket and panel plug
1 TO-220 clip-on heatsink, Thermaloy 6038 or equivalent
1 Scotchcal front panel, 192 x 59mm
12 Isostat key switches, 5 blue, 3 red, 2 green, 2 white
1 3.58MHz crystal
2 40-pin DIL sockets (see text)
1 24-pin DIL socket (see text)

SEMICONDUCTORS
1 MC6802 microprocessor
1 MC6821 PIA
1 74LS74 dual D flipflop
1 74LS00 quad NAND gate
2 7404 hex inverters
1 74C14 hex Schmitt trigger
1 MM5369 divider, 60Hz version
1 2716 2K EPROM with EA Car Computer program
1 7805, LM340T 5V regulator
5 BC327 PNP transistors
1 BC549 NPN transistor
1 BD139 NPN transistor
3 1N4002 1A silicon diodes
1 1N4148, 1N914 small signal diode
4 FND507 common anode displays, or equivalent
8 5mm red LEDs plus matching bezels

CAPACITORS
1 1000μF/16VW PC mounting electrolytic
1 100μF/16VW PC mounting electrolytic
1 10μF/16VW PC mounting electrolytic
1 10μF/16VW tantalum or low leakage electrolytic
8 0.1μF monolithic
3 .01μF metallised polyester
2 27pF miniature ceramic

RESISTORS (¼W, 5% unless stated)
1 × 1MΩ, 2 × 100kΩ, 1 × 56kΩ, 3 × 10kΩ, 1 × 4.7kΩ, 4 × 3.3kΩ, 1 × 2.2kΩ, 5 × 1kΩ, 4 × 560Ω, 8 × 33Ω, 1 × 82Ω 1W.

SENSORS (see text next month)
1 fuel flow sensor, Prince or Moray
1 distance sensor, Compucruise or Pimac
1 length of brass rod, 5mm diameter x 20mm long
1 T-junction piece to suit
1 length of fuel line hose plus clamps to suit

MISCELLANEOUS
Hook-up wire, solder, PC stakes, screws, nuts, etc

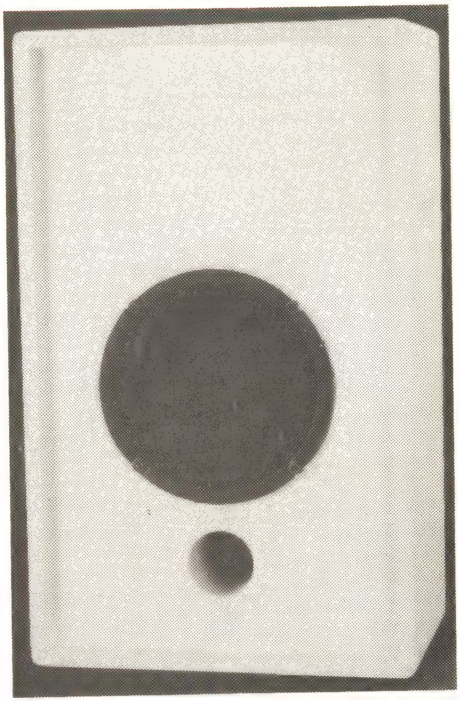
NOTE: Components specified are those used in the prototype. In general components with higher ratings can be used providing they are physically compatible.

New design uses near ideal 250mm woofer

100W sub-woofer speaker enclosure

This compact sub-woofer system will augment the bass response of stereo sound systems down to below 30Hz. The enclosure shape is not critical and could be built into a coffee table or end table to be unobtrusive.

by LEO SIMPSON



The prototype is ugly. Kit versions will be finished in black vinyl.

Last year in August and September we published articles on "Vented Speaker Systems" by Brian Davies. These articles elucidated the principles of loudspeaker design evolved by A. N. Thiele and R. H. Small. As such, the articles have created a great deal of interest amongst audio enthusiasts, particularly those who are interested in building their own loudspeaker enclosures, using locally available drivers.

One message is made abundantly clear in the above two articles and that is that the traditional much-regarded large vented system using a 30cm woofer is not an optimum design, particularly as the enclosure volume is made smaller. If you want to guarantee a good bass response down to 40Hz or below, it is extremely difficult to obtain it with a modest enclosure using a 30cm woofer.

For a more reasonably-sized enclosure giving reasonable bass response, a woofer diameter of 20 or 25cm is far more suitable. But until recently there has been a dearth of locally available woofers of this size which had suitable figures for Q_t and V_{AS}. Recognising this, major kitset supplier Jaycar Pty Ltd has arranged for the local manufacture of a 25cm woofer with near ideal characteristics.

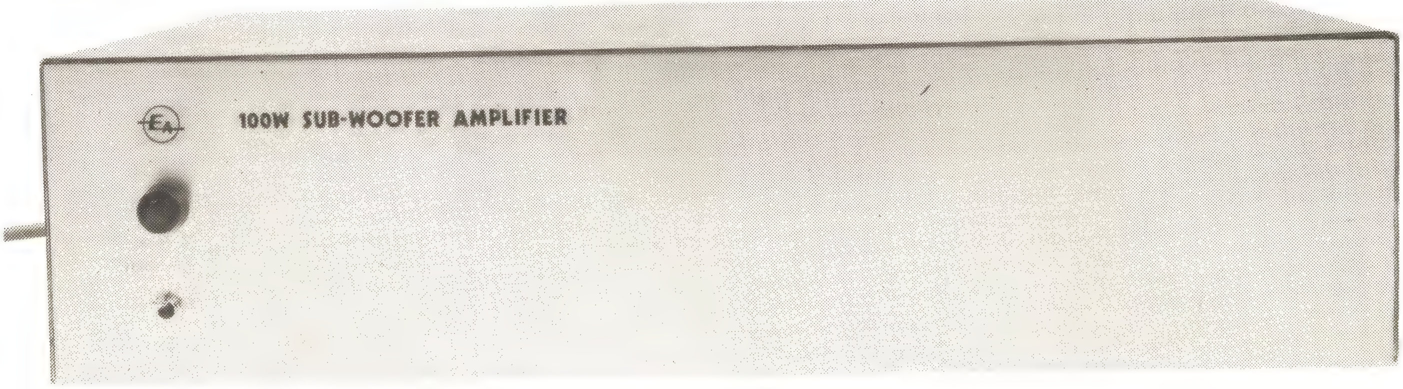
The new woofer is designated the SW-250, although the staff at Jaycar are prone to call it by more picturesque names such as the "gut-rumbler" or the "wall-wobbler". Anyway, the SW-250, to call it by its more prosaic appellation, is a really rugged design with a power handling capacity of 100 watts.

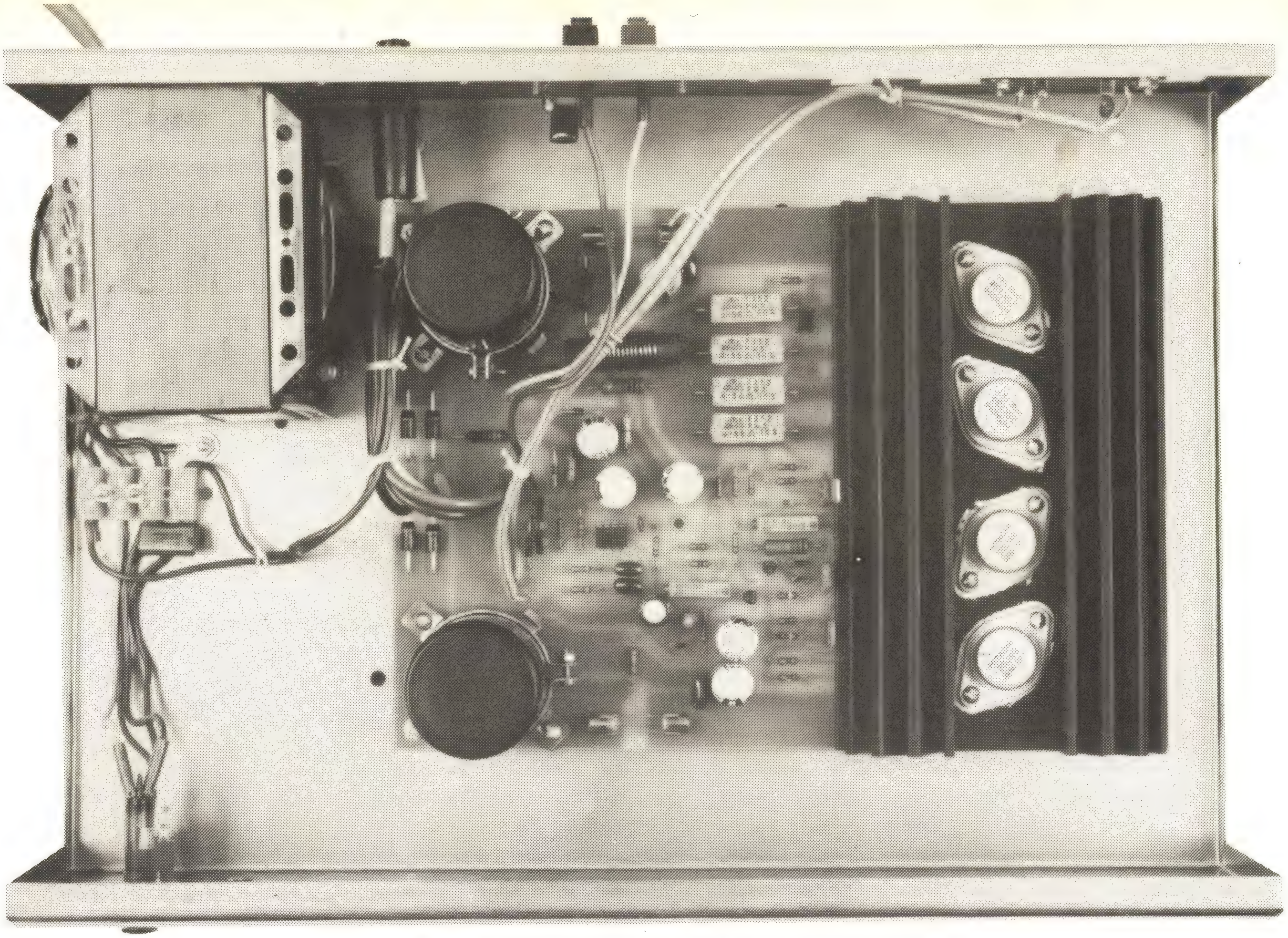
It has a substantial cast aluminium chassis and a total mass of almost four kilograms of which three kilograms is the mass of the large ceramic magnet. The heavy curvilinear cone is treated with a viscous damping material and has a large multiple corregation surround and large spider assembly to ensure linear cone excursions at high power levels.

The SW-250 also has a ridiculously large dustcap which may suggest an equally large and massive magnet pole-piece. In reality though, the magnet pole-piece is still quite large at about 50mm in diameter and is in proportion with the overall magnet diameter of 133mm.

Free-air resonance of the new woofer is quoted at 32Hz while the Q_t figure is an almost ideal value of 0.39. The "equivalent volume" or V_{AS} is 63 litres. For the full background to this ter-

The sub-woofer amplifier uses the 100W power module described last month.





Inside the sub-woofer amplifier. Make sure that there is no connection between the board pattern and chassis (see text).

minology, readers should refer to the above-mentioned articles (File Nos: 1/SE/57, 58 and 59).

Efficiency of the SW-250 woofer is in line with what can be expected, given the above parameters. This means that it is about average at 88dB for an input of 1 watt and at a distance of one metre, on the axis of the woofer. Combined with the above-mentioned power rating of 100 watts, the maximum practical sound pressure available from the woofer will be 108dBA.

Thus, the efficiency and maximum power handling of the new woofer mean that, when it is teamed with the 100 watt module described last month, it will be able to match with most compact loudspeaker systems.

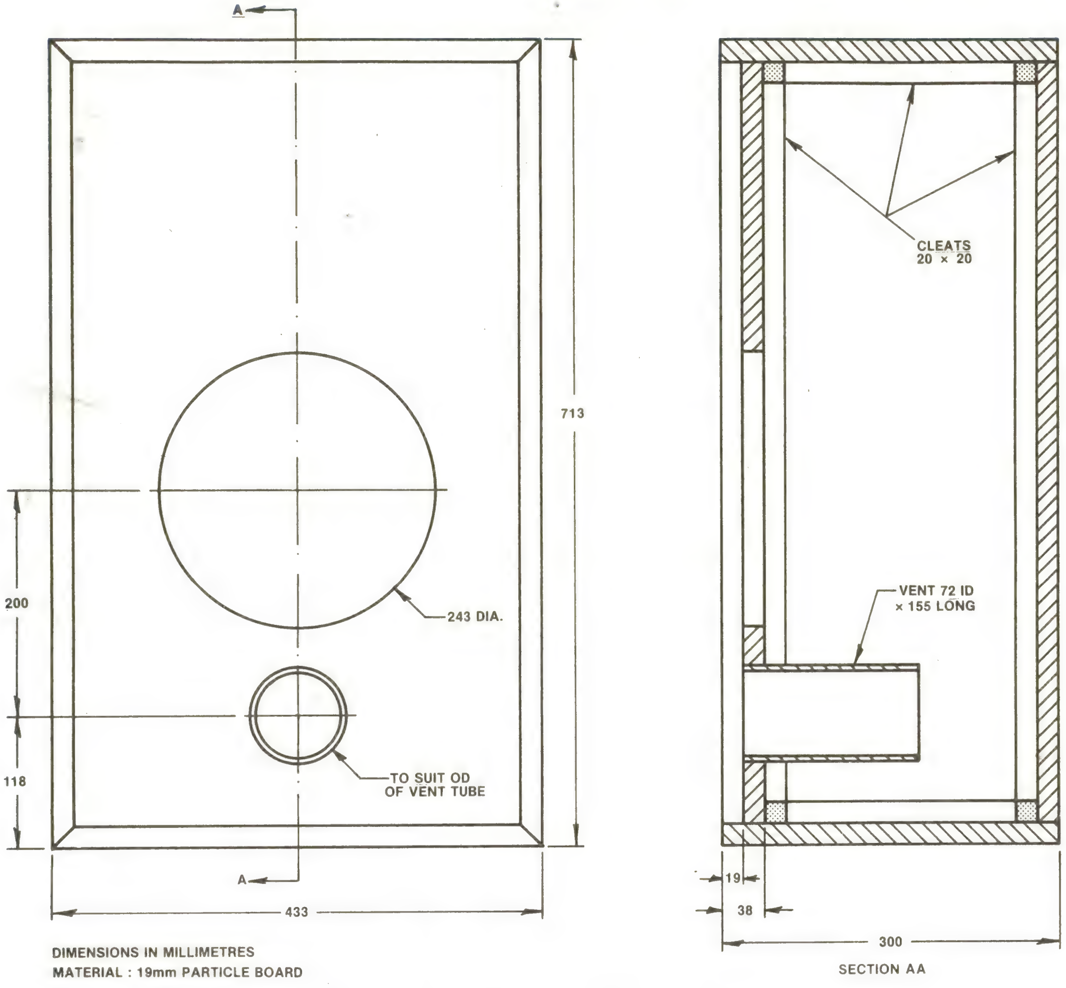
As well as arranging for the manufacture of the SW-250 woofer, Jaycar has also commissioned a design for a suitable enclosure according to the principles of Small and Thiele, as mentioned above. This design is a vented enclosure with a total volume of 63 litres, ie, equal to the V_{AS} figure for the woofer.

The resulting sub-woofer system has a near ideal bass response over the region from 30Hz to above 400Hz, as shown by the accompanying frequency response plot. In fact, over the region from 50Hz to 400Hz, the response is as flat as any loudspeaker is ever likely to be, using a close-microphone test.

And as might be expected from such a response curve, the bass is particularly smooth to the ear, with no evidence of frequency doubling at all, even at high power levels.

The impedance curve is also a "copybook" specimen, with peaks at

The SW-250 woofer has near ideal characteristics for this application. Free-air resonance is 32Hz, Q_t is 0.39, and V_{AS} is 63 litres.



EA 100 WATT SUB-WOOFER ENCLOSURE

These dimensional details are supplied for those who wish to build their own enclosures. Actual dimensions are not critical, provided the volume remains the same (see text below).

about 15Hz and just below 50Hz, corresponding to the two system resonances (f_H and f_L) while the dip is at just below 30Hz. Since the system does not use a passive crossover network, the minimum impedance of the system is just above the DC resistance of the SW-250 driver, at 6.1 ohms.

Construction

As presented in this article, the prototype (which is as ugly as sin) follows conventional lines and uses a cardboard tube as the tuned port. We understand that Jaycar will have precut enclosure kits (of the "fold around the baffle type") which will be finished in black vinyl. For those who can build their own enclosure from scratch, we have provided a dimensional diagram, with timber cleats as the panel fixing method.

But the important point to note about this enclosure is that the actual dimensions are not at all critical. As long as the enclosure volume is close to the design figure of 63 litres (give or take a few litres) and the distance from the end of the tuning port to the rear panel is not less than in our diagram, the box can be almost any shape at all. And the port can be cut into any of the six panels (it does not have to be on the woofer panel).

This means that the sub-woofer enclosure can be built into a piece of furniture such as an end table, or even built into a sofa to make it as unobtrusive as possible. As a further advantage, this means that the main stereo speakers can be really compact and also unobtrusive, as they only require a bass response down to around 100Hz or so. In fact, for an absolute minimum enclosure for the main stereo speakers, the response need only extend down to about 200Hz and embody only tweeter and midrange drivers.

No special constructional procedure is required in building the sub-woofer enclosure apart from normal provisos such as ensuring that the panels are thick enough to avoid undue resonances which would add harmonic distortion to the reproduction. Naturally, the system must be thoroughly sealed to avoid any leaks around the woofer itself, at the panel joins and at the connection terminals. A curtain of bonded acetate fibre (BAF) should be placed loosely over the rear of the woofer and tacked to the baffle, but apart from that, no enclosure filling is required.

Housing the amplifier

Our first thoughts, in solving the problem of driver amplifier accommodation, were to house the amplifier in the plinth of the subwoofer enclosure. However, that course is really only practical if a conventional enclosure is used. Even then it does have drawbacks in that a power cord and two pairs of loudspeaker leads (from the two channels of the main stereo amplifier) would need to be run to the enclosure.

Bill Edge's

ELECTRONIC AGENCIES

115-117 Parramatta Rd., Concord 2137
(Corner Parramatta Rd & Lloyd George Ave)
Telephone (02) 745 3077 (two lines)
117 York St. Sydney Phone 29 2098

bankcard welcome here

TRADING HOURS
BOTH STORES
Mon-Fri . . . 9am-5.30pm
Thursday . . . 9am8 pm
Saturday . . . 9am-12pm

Mail Orders:
PO Box 185
Concord
2137

MAIL CHARGES	
$5-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100 or more	$6.50

All heavy or bulky items (over 20 kg) sent Comet Road Freight $10.00 anywhere in Australia

what else do we carry? HI-FI ★ KITS ★ TEST EQUIPMENT ★ SEMICONDUCTORS ★ COMPONENTS ★

All prices correct and goods in stock at time of going to press. Please phone to check current availability

ETI 5000 POWER AMP NOW WITH SUPERB FINISH PANEL LOOK

- — Superb Finish Front Panel Heatsink, tapped so no screws are visible.
- — Ferguson transformers supplied, not cheaper equivalents.
- — Pre Built chassis designed in conjunction with David Tilbook, with a screw lid for easier access.
- — Specially written instructions by Phil Waite.
- — Bill own Kit Constructors guide.
- — WHY RISK BUYING A POWER AMP WITHOUT ALL THESE FEATURES

STILL ONLY $295
KE5050

ETI 5000 SERIES "PROFESSIONAL" PREAMP UPGRADED VERSION

Includes:
- — Gold Plated sockets on ALL inputs not just phono. 24 in all.
- — 2 Gold RCA Plugs for phono.
- — IC sockets provided where physically possible.
- — All metal film resistors.
- — Silver Anodised rear panel with silkscreened lettering and format borders.
- — Bill's kit constructor guide.

ALL THIS FOR THE PRICE OF THE NORMAL KIT

$245 **KE5000** **SAVE $30**

ALARMS
LEDLUX 4 SECTOR CONTROL MODULE

Ledlux is an alarm module suitable for both household and commercial use

Features:—
- Adjustable entry delay time.
- Fixed double exit time, on 2 delay sectors — 70 seconds. On 2 Instant sectors 7 seconds
- Inbuilt silent seal test on sectors, shown by 2 Red Leds
- Inbuilt power on signal and battery voltage monitor shown by green Led
- Inbuilt siren driver. Can drive 3 horn speakers and 1 bell
- Adjustable sound speed from — a slow wail to fast worble
- Adjustable sound time (when alarm is triggered) from 1-20 mins (pre-set at 10 mins.)
- Size 110 x 85 x 20 mm fully insulated
- Operation voltage 6-16 v. nominally 12
- Operation current 600 MA. so can be used with dry batteries

$69.50
LE8575

0-20 volt Motors suitable for hobbyists SE7000 **$3.95**

LEDLUX MAXIPANEL

The Ledlux module as described plus the following features—
- Fitted in an attractive Hammertone brown box 340 x 225 x 140 mm
- Tamper protected hinged lid
- Tamper protected from unit to wall on which mounted
- Fitted with a reflex horn speaker, key switch with 2 keys
- Warning decals included
- Supplied pre wired and fully tested
- Case is big enough to contain a 12v mains supply plus 12v rechargeable battery

$189.50
LE8580

To power the Ledluxes we recommend a 12 volt GEL rechargeable battery

Cat No. SE2700 $34.50

This battery can be kept recharged and the alarm operational on 240v by a trickle charger

Cat ME7795 $18.95

Extra hornspeakers available **CE2807** 5" Round **$9.95** or **CE2809** 8" x 5" **$26.00** — Both alarms can be used with Radar Motion Detector

6 HOUR TURNAROUND ON MAIL ORDERS

RBLL Capacitors now available

- 20% tolerance
- Leakage current less than tantalums
- Small case size
- PCB compatible
- Far cheaper than tantalums
- As used in some projects

			1-9	10uf	100uf
RE6000	1 uf	50v	.35	.30	.22
RE6005	22 uf	50v	.35	.30	.22
RE6010	33 uf	50v	.35	.30	.22
RE6015	47 uf	50v	.35	.30	.22
RE6020	1 uf	50v	.35	.30	.22
RE6025	1 5 uf	50v	.35	.30	.22
RE6030	2 2 uf	50v	.35	.30	.22
RE6035	3 3 uf	50v	.35	.30	.22
RE6040	4 7 uf	50v	.35	.30	.22
RE6045	6 8 uf	35v	.35	.30	.22
RE6050	10 uf	35v	.35	.30	.22
RE6055	22 uf	36v	.35	.30	.22
RE6060	33 uf	25v	.50	.45	.35
RE6065	47 uf	25v	.50	.45	.35
RE6070	100 uf	25v	.50	.45	.35

RUNOUT SALE ON PLESSEY SPEAKERS

Limited quantities available only
CE2119 CZ50L09 10" Woofer 50 watts handling was **$25.50**
NOW ONLY $16.50.
SAVE $9 Freq range 32 — 6 kh2

CE2110 C200L09 8" Woofer 30 watts was **$14.50**
NOW ONLY $10.50.
SAVE $4 Freq range 46 — 8 kh2

CE2075 C130M06 5" Midrange 30 watts was **$11.50**
NOW ONLY $8.50.
SAVE $3 Freq range 1 2 k — 15 kh2

If you have been holding off buying the Electrostatic tweeter because of its price then now is the time to buy

CE2042 was **$36.50**
NOW ONLY $18.50.
SAVE $18.00 50 watts 5 kh2 — 40 kh2

CE2003 C050N08 Cone tweeter 60 watts Freq range 3 — 20 kh3 was **$7.95** **NOW $4.50**
SAVE $3.45

Radar motion detector

This great little unit uses the doppler principle to detect movement within an area. Operates on 12VDC 160mA. has normally open and normally closed outputs capable of switching 12VDC at 150mA. Holds for 3 seconds on triggering or continuously if movement continues within the 3 seconds. Has built in 'walk-test' for adjustment two LEDs let you adjust the unit's aim for optimum performance. Maximum range of 7 5m long x 4 5m wide

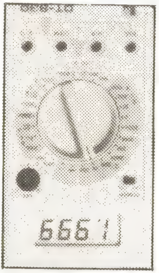
$95.00
LE8650

MAIN SUPPRESSION CAPS

- Constructed of metallised polyethylene terephalate film
- Designed for use in 250v AC mains suppression circuits
- Working temperature -40 C to +85 C
- PCB mounting pins
- Fully sealed against moisture

		1-9	10up	100up
RE6500	01 uf	.60	.50	.38
RE6510	022 uf	.70	.60	.50
RE6510	03 uf	.70	.60	.50
RE6515	047 uf	.90	.80	.65
RE6520	1 uf	1.10	1.10	.85
RE6525	22 uf	1.50	1.40	1.20
RE6530	47 uf	2.40	2.20	1.80

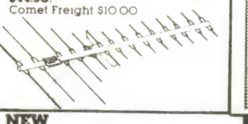
DT 830 DIGITAL MULTIMETER



30 Ranges
Transistor and diode checker
QE5231 **$98.50**
Probe for transistor checker
QE5287 **$4.20**
Case QE5284 **$6.50**

UHF/VHF COMBINED TV ANTENNA

Excellent pick up on UHF and VHF TV's and some BETA VCR's LE6282 **$44.50.**
Comet Freight $10.00



WE ARE THE KIT SPECIALISTS

★ SPECIAL ★
PEERLESS PASION SPEAKER KIT with cabinets

Kit includes —
12" Woofer dome midrange dome tweeter fully built cabinets with cloth mounted on the front
Normally $638.00
This month
ONLY $499.00 PAIR
Limited Quantity
Comet Freight $20.00

NEW BOOKS

BE8000	Building HiFi Spk enclosures	8.75
BE8001	HiFi Speaker Systems	9.95
BE8003	Beginners Handbook of Amateur Radio	15.95
BE8010	IC OP Amp Cookbook	23.75
BE8015	555 Applications	11.25
BE8020	Transitor Substitution Handbook	8.75
BE8023	Intrusion Alarm	9.75
BE8025	Troubleshooting with Cro	15.95
BE8030	Colour TV Servicing	13.25
BE8028	TV Antennas & Systems	15.95
BE6062	Top Projects Vol 8 ETI	4.95
BE6065	How to Build Electronic Games ETI	3.95
BE6068	Electronic Projects for the young Scientists ETI	3.95
BE6006	Electronic for Beginners	14.95
BE8008	Electricity and Introduction to Electronics	12.75
BE8032	Solar Heating	9.95

NEW
12/230v 300VA INVERTER KIT

See EA JUNE 82 Run your 12 volt appliances in your car Great for power strikes Kit includes everything even handles KE4085 **$195.00**
IC4026 All parts available separately
NOW AVAILABLE
ZE5026 **$2.95**

KIT BUYERS BEWARE

Customers from interstate have told us that we have the best kits they have seen. They have said to us "Why don't you tell people. We didn't know a kit supplier existed who sells kits of such great quality" So we are taking their advice

WE SELL THE BEST KITS.

WE SELL THE BEST KITS

OUR STANDARD EVERYDAY LED PRICES

	1-9	10 up	100 up
ZE1801 LED FLASHING RED	.50	.45	.36
ZE1811 LED SMALL RED 3 mm	.20	.15	.12
ZE1819 LED SMALL GREEN 3 mm	.20	.15	.12
ZE1821 LED SMALL YELLOW 3 mm	.20	.15	.12
ZE1832 LED LARGE RED 5 mm	.15	.09	.07
ZE1836 LED LARGE GREEN 5 mm	.30	.25	.20
ZE1840 LED LARGE YELLOW	.30	.25	.20
ZE1844 LED LARGE ORANGE	.30	.25	.20
ZE1850 LED RECTANGULAR RED	.30	.25	.18
ZE1854 LED RECTANGULAR GREEN	.30	.25	.18
ZE1856 LED RECTANGULAR YELLOW	.30	.25	.18

PLEASE ASK US FOR OUR TAX FREE QUANTITY PRICES ON SEMI-CONDUCTORS AND CAPACITORS.

Compare our usual price for semi-conductors

			100 up				100 up
ZE0205	BC547	.10	.085	ZE5301	LM301	.60	.34
ZE0213	BC548	.10	.085	ZE5380	LM380	1.65	.96
ZE0224	BC549	.10	.085	ZE5555	NE555	.35	.30
ZE0245	BC557	.10	.085	ZE6005	NE7805	.95	.66
ZE0253	BC558	.10	.085	ZE6012	NE7812	.95	.66
ZE0264	BC559	.10	.085	ZE6015	NE7815	.95	.66
ZE0755	CQ489A	.85	.59	ZE6115	NE7905	1.50	.99
1 watt Zenor diodes		.35	.22	ZE6122	NE7912	1.50	.99
ZE4001	4001	.35	.24	ZE6125	NE7915	1.50	.99
ZE4011	4011	.35	.24	ZE6030	LM3177	2.30	1.56
ZE4017	4017	.95	.63	ZE6514	LM2114	2.75	2.36
ZE4040	4040	1.20	.95	ZE5499	LM2716	7.50	4.50

FREE WITH ALL KITS OVER $20 BILL'S OWN KIT CONSTRUCTOR'S GUIDE

NEW *PIONEER*

Separate Speakers now available. Compare these prices for power handling and quality!

12 INCH WOOFER
14 oz. Ferrite Magnet

Power Rating	65 WATT (RMS)
Nominal Resonant Freq (fo)	23-28 Hz
Nominal Sensitivity	97(dB/W)
Response Range	fo — 2.500 Hz

$32.50
CE2121

12 INCH WOOFER
30 oz. Ferrite Magnet

Power Rating	90 WATT (RMS)
Nominal Resonant Freq (fo)	20-25 Hz
Nominal Sensitivity	99(dB/W)
Response Range	fo — 2 000 Hz

$45.00
CE2128

4½ INCH MID RANGE
30 oz. Ferrite Magnet

Power Rating	15 WATT (RMS)
Nominal Resonant Freq (fo)	700 Hz
Nominal Sensitivity	99(dB/W)
Response Range	700 — 6.000 Hz

$6.50
CE2070

10 INCH WOOFER
11 oz. Ferrite Magnet

Power Rating	50 WATT (RMS)
Nominal Resonant Freq (fo)	25-30 Hz
Nominal Sensitivity	96(dB/W)
Response Range	fo — 2.500 Hz

$27.50
CE2117

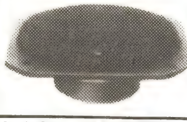
8 INCH WOOFER
9.3 oz. Ferrite Magnet

Power Rating	30 WATT (RMS)
Nominal Resonant Freq (fo)	45-50 Hz
Nominal Sensitivity	99(dB/W)
Response Range	fo — 3 000 Hz

$15.50
CE2111

5 INCH MID RANGE

302 Power Rating 30W (RMS)



$13.50
CE2078

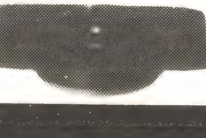
2½ INCH HORN TWEETER
2.2 oz. Ferrite Magnet

Power Rating	12 WATT (RMS)
Cross Over Freq (fo)	2000 Hz
Nominal Sensitivity	101 (dB/W)
Response Range	2.000-20 000 Hz

$9.50
CE2014

1 INCH DOME TWEETER
6.3 oz. Ferrite Magnet

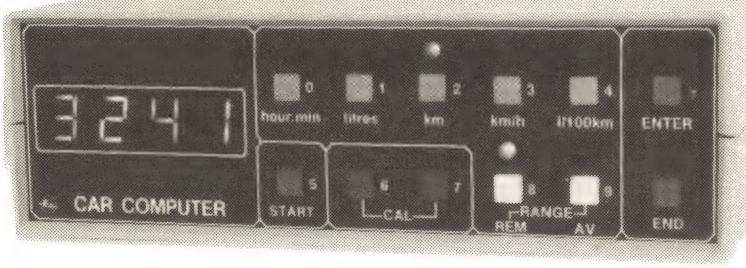
Power Rating	25 WATT (RMS)
Cross Over Freq (fo)	2.000 Hz
Nominal Sensitivity	95 (dB/W)
Response Range	2.000-20.000 Hz



$12.50
CE2015

CAR COMPUTER KIT

THIS GREAT NEW EA DESIGN IS AVAILABLE FROM JAYCAR!!!



NOTE! *The Jaycar kit uses the* **ORIGINAL** *high quality Pac-Tec Case.* **BEWARE** *of kits supplied with cheap substitutes! Ask First!*

Unit pictured is EA prototype. The Jaycar kit will have professional silkscreened front panel, **NOT** *a scotchcal panel.*

SAVE A FORTUNE ON PETROL BILLS!!

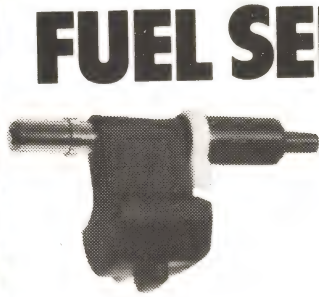
—YOU WILL KNOW EXACTLY HOW MUCH FUEL YOU ARE USING AND THE RATE AT WHICH IT IS BEING USED!!!

CALCULATES
- FUEL ECONOMY (INSTANTLY AS YOU TRAVEL ALONG) IN LITRES/100KM.
- AVERAGE ECONOMY OVER A TRIP.
- AMOUNT OF FUEL USED SO FAR
- AMOUNT OF FUEL NEEDED (BASED ON AVERAGE USE) TO COMPLETE TRIP. ALSO TIME REMAINING.
- ELAPSED TIME
- SPEED IN K'S/HR. MORE ACCURATE THAN CAR SPEEDO
- DISTANCE TRAVELLED/REMAINING
- HOW FAR YOU CAN GO ON FUEL LEFT

FROM $109 50

Ref: JULY/AUG 82

FUEL SENSOR



'T' piece optional extra if needed.

$45

This is a genuine English 'PIMAC' unit that was strongly recommended by EA. Measures fuel from 1—100 litres per hour. Output 20,000 pulses/litre, CMOS/TTC Compatible.
A comprehensive data sheet is supplied with each unit.

pricing * * * * * * information

All Electronics including both PCB's plated-through, programmed EPROM, 1% metal film resistors, high spec components and YOUR CHOICE of either speedometer cable speed sensor OR tailshaft sensor. (Please specify) $109.50

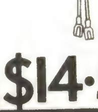
Pre-Punched case with, special silk screened panel and multi-way connector. $29.50

'PIMAC' High resolution Fuel Sensor $45.00

IF PURCHASED TOGETHER ONLY $179 — WITH EXCLUSIVE LITRE/100KM—MPG CONVERSION CHART

* speed sensors *

Two types available. Both operate with the EA Car Computer and give much the same results. The speedo cable unit is handy for front-wheel-drive or cars which have no tailshaft. This unit does require the speedo cable (outer sheath) to be cut. It does not affect the operation of the speedometer in any way and can be used with tailshaft cars also. The magnet/coil unit is only really suitable for cars fitted with tailshafts, but the speedo cable is not touched.



$19·50

TAIL SHAFT TYPE (COIL/MAGNET) $14.50
SPEEDO CABLE TYPE $19.50

$14·50

COMING SOON!!! THE NEW JAYCAR CAR COMPUTER. NOT A KIT. HAS MANY EXCLUSIVE FEATURES INCLUDING SWITCHABLE MPG/LITRES/100KM READOUT. ONLY $199 INC. ALL SENSORS.

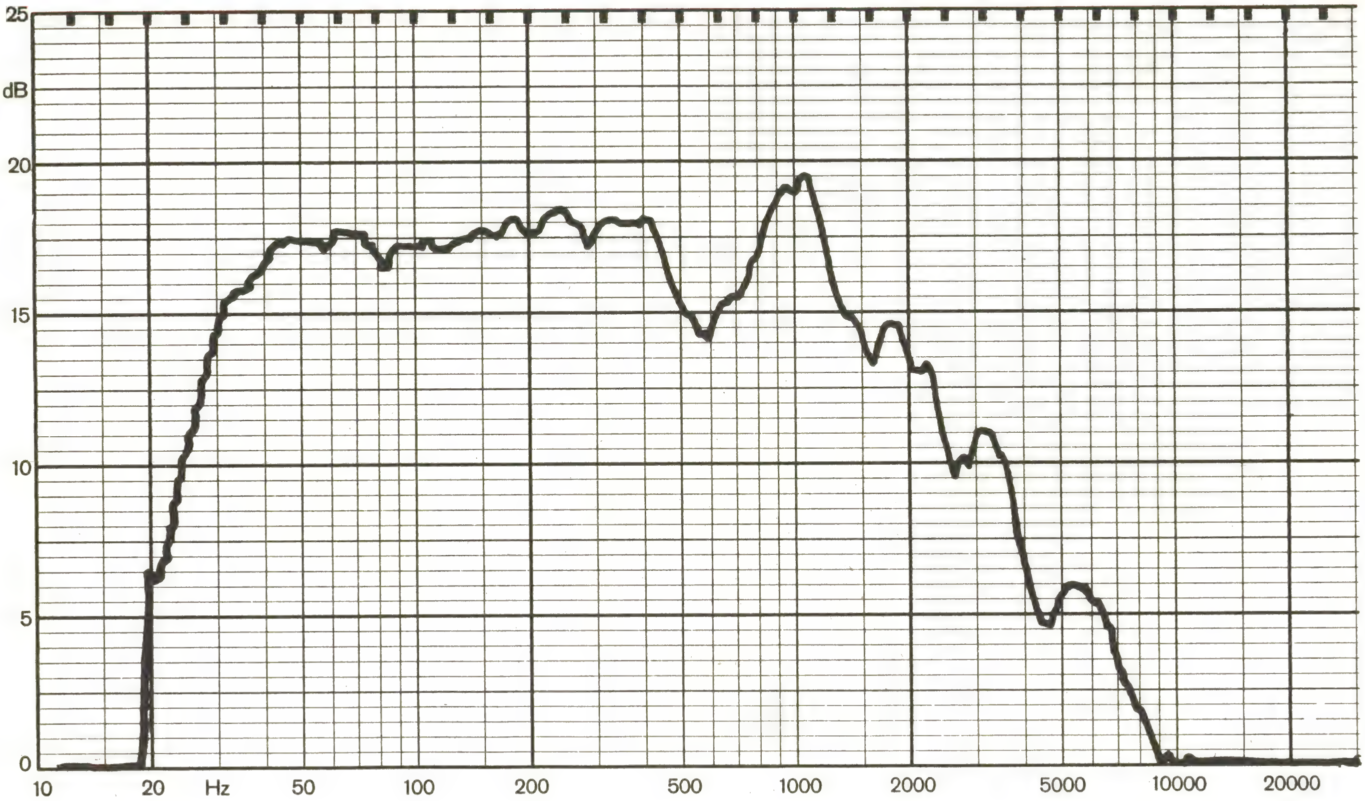
Jaycar

125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293
Mail Orders To:
Box K-39 Haymarket 2000

NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

Post and Packing charges

$5-$9.99 ($1.20)	$10-$24.99 ($2.40)
$25-$49.99 ($3.50)	$50-$99.99 ($4.60)
$100 up ($6.20)	



The graph shows the frequency response of the system at 1W, using a microphone at 15cm on-axis.

Add to that the need for adequate ventilation and a pilot light to indicate that power is present and a powered sub-woofer enclosure may not be all that attractive. So we took the alternative approach of housing the sub-woofer amplifier in a conventional chassis which can be positioned in or out of sight, near the main stereo amplifier.

This will mean that power cord and signal connections can be short and unseen, and a single run of heavy-duty figure-8 cable is all that is required to make the connection to the sub-woofer enclosure.

Accordingly, we decided to house the sub-woofer amplifier module described last month in a chassis which measures 370 × 248 × 90mm (W × H × D) and has a wrapover Marviplate cover. Suitable chassis should be available from Jaycar or selected resellers shortly after this article appears. In fact, there is nothing particularly special about the chassis apart from the need to provide a reasonable amount of ventilation for the on-board heatsink. This can be provided by drilling a number of holes in the base and rear panel of the chassis.

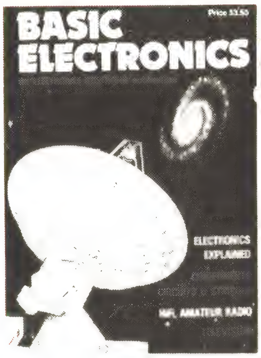
(Our prototype chassis already had a number of cutouts in the rear panel, thus avoiding the need for drilling).

Preparation of the chassis starts with drilling any necessary mounting holes for the sub-woofer module, power transformer and other hardware. The transformer we used was the Ferguson PF4361/1 which has a copper flux shorting band. In this application the shorting band is probably not necessary so some money could be saved by purchasing the non-banded version, PF4361.

Not a great deal of wiring is involved and a few hours' work should see the amplifier complete. Follow the circuit published last month and the wiring diagram in this article when wiring the chassis. The mains wiring is most important and the wiring diagram should be closely followed. It incorporates a neon bezel which was not included in the circuit published last month.

The mains cord should be passed through a grommetted hole in the rear of the chassis and anchored with a cord clamp. Terminate the mains active (brown or red) and neutral (blue or black) wires to the insulated terminal block and solder the earth (green or green with yellow stripe) wire to a solder lug near the transformer.

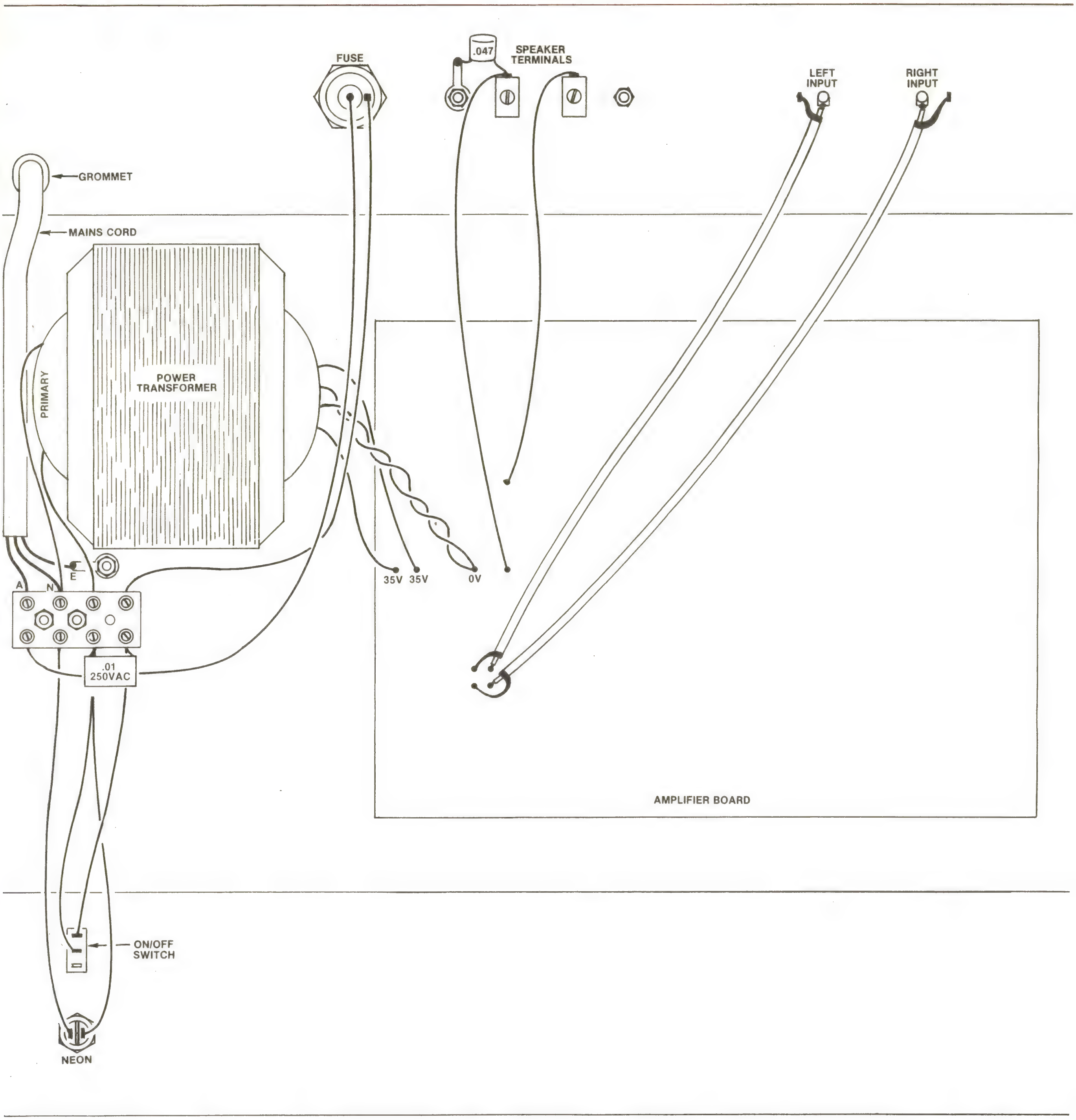
The mains switch has a .01μF interference suppression capacitor wired across it, at the insulated terminal block. Keep the leads to this capacitor reasonably short and sleeve them if necessary with Nylex and spaghetti to prevent them from contacting the chassis (or the user). This interference suppression capacitor must be rated for 250VAC operation. This means that it must either be a metallised paper or dual



Basic Electronics

For the beginner, or for the hobbyist, this reference book is almost certainly the most widely used manual on basic electronics in Australia.

Available from "Electronics Australia", 57 Regent St, Chippendale, PRICE $3.50 OR by mail order from "Electronics Australia", PO Box 163, Chippendale 2008. PRICE $4.40.



Wiring details for the 100W sub-woofer amplifier. Not that mains wiring should use 250VAC-rated cable.

dielectric (paper plus polyethylene terephthalate) type rated at 250VAC, a metallised polypropylene type with a rating of 250VAC or 1kV or 1600VDC or a ceramic disc capacitor rated at 2kV or higher.

Do not use polyester or polypropylene capacitors rated at 630VDC or 220VAC. They could be a potential fire hazard.

The mains fuse is wired in series with the active lead, before the power switch. The input to the fuse should be made to the end terminal while the switch is wired to the side terminal. Both terminals should be sleeved after the connections are made, to avoid later accidental contact with the mains potential.

Before the sub-woofer module can be installed, the four heavy-gauge secondary wires from the transformer must be terminated. Thoroughly clean the lead ends of varnish with a razor blade and tin them with solder. Then pass each of the four leads through its appropriate hole on the PC board and solder.

Now install the module using four PC standoffs or screws, nuts and spacers. Make sure that there is no connection between the PC board pattern and the chassis, via the module mounting screws. This can be tested by checking for continuity between the module earth connection and chassis. If there is any continuity, remove the module and rectify the problem before proceeding fur-

ROD IRVING ELECTRONICS

425 HIGH STREET, NORTHCOTE 3070. MELBOURNE. (03) 489-8131.

ELECTRONIC COMPONENT SUPPLIERS, DESIGNERS & MANUFACTURERS.
RITRONICS WHOLESALE (03) 489-7099. MAIL ORDERS (03) 481-1436.
TELEX: AA38897

For heavier items add additional postage. Extra heavy items sent Comet freight on. Prices subject to change without notice. Send 60c and SAE for free catalogues. Minimum pack and post $1.00. Bankcard Mail Orders welcome.

DIP SWITCHES SPST

P/N	No. Switches	Price
SD3	3	1.60
SD4	4	1.70
SD5	5	1.90
SD6	6	2.30
SD7	7	2.40
SD8	8	2.50
SD9	9	2.70
SD10	10	3.00

WIRE WRAP 3-LEVEL

	1-9	10-25
8 Pin	1.00	.90
14 Pin	1.10	1.00
16 Pin	1.20	1.70
18 Pin	1.50	1.40
20 Pin	1 80	1.60
22 Pin	1.90	1.70
24 Pin	2.00	1.80
28 Pin	2.20	2.10
36 Pin	2.60	2.40
40 Pin	2.90	2.70

COMPUTER GRADE ELECTRO.

2900uf	40V	6.50
6800uf	16V	6.40
10,000uf	16V	9.00
10,000uf	25V	9.50
10,000uf	40V	11.90
15,000uf	40V	12.00
22,000uf	25V	12.90
22,000uf	40V	23.00
27,000uf	35V	23.50
33,000uf	16V	23.50
68,000uf	16V	21.50
100,000uf	10V	20.50

MULTISTRAND RIBBON CABLE
Price per m tre

	1-9	10+
10 Way	.90	.80
12 Way	1.00	.90
16 Way	1.20	1.10
20 Way	1.70	1.60
40 Way	3.20	3.00

SUPER SPECIALS

2708	$ 4.50	BU326	$ 1.90
2716	$ 4.90	Z80S10	$21.00
2732	$ 8.00	1771	$19.00
6800	$ 7.90	1791	$59.00
6802	$11.00	1795	$59.00
6809	$22.00	4116	$ 1.95
8085	$12.50	2114	$ 1.95
8080	$ 7.00	TA7205	$ 3.30
6821	$ 3.50	100 Red Leds	$ 9.00
Z80P10	$ 5.00	BUX80	$ 3.90
		BU126	$ 1.90

CMOS	
4000	.40
4001A	.40
4001B	.40
4002	.50
4006	1.10
4007	.50
4008	1.00
4009	.80
4010	.50
4011	.40
4012	.50
4013	.80
4014	1.70
4015	.90
4016	.70
4017	1.50
4018	1.50
4019	.60
4020	1.20
4021	1.10
4022	1.05
4023	.70
4024	1.00
4025	.50
4026	2.20
4027	.60
4028	.90
4029	1.20
4030	.60
4031	2.20
4034	3.00
4035	1.30
4039	.70
4040	1.70
4041	1.05
4042	.70
4043	.70
4044	.70
4046	1.20
4047	1.20
4048	.60
4049	.60
4050	.60
4051	1.00
4052	.80
4053	.80
4060	2.00
4066	.80
4068	.60
4069	.70
4070	.50
4071	.60
4072	.50
4073	.60
4075	.60
4076	1.20
4077	.50
4078	.60
4081	.60
4082	.60
4089	1.00
4093	.80
4503	.60
4510	1.50
4511	1.50
4512	1.10
4514	2.50
4516	1.40
4518	1.50
4519	.55
4520	1.60
4522	1.25
4527	1.20
4528	1.25
4529	1.60
4539	1.60
4541	1.60
4543	2.00
4553	5.50
4555	1.00
40097	.95
40098	.95
40175	1.00
74C SERIES	
74C100	.40
74C02	.40

74C04	.40
74C08	.40
74C10	.40
74C14	.90
74C20	.40
74C30	.40
74C32	.40
74C42	1.10
74C48	1.55
74C73	.75
74C74	.70
74C76	.75
74C83	1.40
74C85	1.20
74C86	.80
74C90	.80
74C93	1.40
74C95	.95
74C107	.70
74C150	3.40
74C151	1.00
74C160	.90
74C192	.90
74C164	1.10
74C173	1.00
74C174	.80
74C175	1.00
74C192	1.20
74C195	1.00
74C221	1.90
74C373	1.80
74C374	2.00
74C901	.90
74C902	.90
74C905	11.20
74C906	.90
74C907	.80
74C915	1.50
74C922	6.00
74C923	5.00
74C925	7.50
74C926	7.50
74C927	5.90
74C932	5.50
80C SERIES	
MM80C95	.90
80C96	.90
MM80297	.90
80C98	.90
LINEAR	
LH0002	9.50
LH0022CD	16.60
LH0042CH	8.60
LH0070	12.70
LH0071	12.70
TL071	1.00
TL072	1.50
TL082	1.50
SAK140	2.20
UAA170	3.50
UAA180	3.50
TCA220	2.20
LM301	.50
LM301-H	.50
LM304-H	1.70
LM305-H	.80
LM307-CN	.40
LM307-H	.90
LM308	.70
LM308-H	1.20
LM310-N	2.20
LM310-H	2.60
311	.60
LM311	.60
LM311-H	1.20
LM318	2.80
LM322	3.90
LM324	1.20
LM325	3.10
LM329-DZ	1.40
LM334-Z	1.30
LM335	12.40
LM336-Z	3.20
LM339	.90
LM348	1.10
LM349	1.80
LF351-N	.70

LF356-AN	1.10
LF357	1.10
LM358	.70
LM373	4.10
LM374	5.40
LM376	.70
LM377	2.90
LM379	5.70
LM308 8PIN	1.30
LM380 14PIN	1.50
LM318A-N	2.40
LM318N	1.80
LM382N	2.00
LM383	2.70
LM384	2.40
LM386	1.00
LM387	1.30
LM391	1.80
LM393	.80
LF398	5.00
8038	6.00
NE530	1.10
OM350	9.90
555	.40
556	1.10
LM565	1.30
LM565CH	2.00
NE566	2.50
LM567	1.50
NE571	6.50
LM709 14PIN	.70
UA710CA	.60
LM710-CH	.90
711	.80
UA711-H	.85
UA716HC	6.25
723	.50
LM723CH	1.10
LM725	3.90
LM733	1.20
UA739	2.00
741	.25
LM741-H	1.20
UA747	1.00
UA747HC	2.20
UA748	.50
UA748HC	1.25
UA753	1.80
UA760HC	4.10
UA777	2.40
UA777HC	2.65
9334	1.70
UA743	1.80
UA760HC	4.10
UA796HC	1.70
LM802	1.10
LM1310N	2.40
1408	4.90
LM1458	.60
UA1488	1.50
UA1489	1.50
MC1495	7.30
MC1496L	11.40
LM1558	1.50
LM1596	1.40
LM1380	3.10
LM2902	1.40
LM2917 8PIN	2.80
LM2917	3.10
CA3028	1.80
LM3039	.90
CA3046	1.70
3065	.45
LM3080	1.20
LM3089	3.90
CA3130T	1.40
CA3130E	1.80
CA3140	1.40
3401	.70
3611	1.10
LM3900	.90
LM3909	1.00
LM3914N	3.90
4136	1.40
LM4250	1.75

UA4558TC	1.40
MM5837	2.50
LM7555	1.80
Mc10116L	.95
LF13741	.60
LF1374-1H	.70
DS75452	.60
76477	4.90
75451	.60
75491	1.40
75492	1.40
TTL (s)	
74S00	.80
74S02	.80
74S04	.80
74S10	.75
74S11	.75
74S32	.75
75S51	.75
74S74	1.20
74S86	1.40
74S112	1.20
74S135	2.20
74S138	3.20
74S157	2.95
74S158	2.95
74S182	3.30
7400 SERIES	
7400	.40
7401	.40
7402	.40
7403	.40
7404	.40
7405	.50
7406	.50
7407	.50
7408	.40
7409	.40
7410	40
7411	40
7412	.40
7413	.50
7414	.70
7416	.50
7417	.60
7420	.40
7421	.40
7423	.50
7425	.45
7426	.40
7427	.40
7430	.40
7432	.40
7437	.40
7438	.50
7440	.50
7441	1.00
7442	.50
7443	1.40
7444	1.20
7445	1.10
7446	1.00
7447	1.00
7448	1.00
7450	.50
7451	.50
7453	.40
8T26	2.20
9300	.60
9307	1.80
9308	1.20
7454	.60
7472	.60
7473	.60
7474	.60
7475	.60
7476	.60
7480	.65
7482	1.80
7483	.80
7485	.80
7486	.60
7489	2.60
7490	.70
7491	.55
7492	.60
7493	60

7494	.90
7495	.45
7496	.80
7497	2.50
74107	.80
74109	.60
74116	2.20
74121	.45
74122	.65
74123	.60
74125	.55
74126	.60
74132	.80
74141	1.10
74145	.85
74147	2.00
74148	1.40
74150	1.20
74151	.60
74152	4.90
74153	.70
74154	1.20
74155	.90
8T28	3.00
9310	.65
9311	1.00
9312	1.35
74156	1.50
74157	.60
74161	1.00
74162	1.00
74163	.85
74164	.60
74165	.60
74174	.50
74175	.90
74176	1.10
74177	1.10
74180	.90
74181	2.30
74182	.90
74184	1.20
74185	1.20
74190	1.00
74191	1.50
74192	1.70
74193	.80
74194	1.10
74195	.65
74196	.85
74197	1.10
74198	1.10
74199	1.30
74221	.90
74290	.90
73293	.90
74365	.80
74366	.80
74367	1.00
74368	1.00
8T96	1.80
9314	1.30
9368	1.75
9370	2.00
74LS SERIES	
74LS00	.40
74LS01	.40
74LS02	.40
74LS03	.40
74LS05	.40
74LS08	.40
74LS09	.40
74LS10	.40
74LS11	.40
74LS13	.50
74LS14	90
74LS15	.40
74LS20	.40
74LS21	.4C
74LS22	.40
74LS26	.40
74LS28	.40
74LS30	.40
74LS32	.40
74LS33	.40
74LS37	.50
74LS38	.50

74LS40	.50
74LS42	.75
74LS47	.85
74LS48	1.00
74LS49	1.00
74LS51	.40
74LS54	.50
74LS55	.55
74LS58	.65
74LS73	.55
74LS74	.60
74LS75	.45
74LS76	.50
74LS78	.50
74LS83	1.00
74LS85	1.00
74LS86	.50
74LS90	.70
74LS92	.90
74LS93	.80
74LS95	.65
74LS96	1.55
74LS107	.60
74LS109	.60
74LS112	.60
74LS113	.65
74LS114	.50
74LS122	.50
74LS123	.75
74LS125	.50
74LS126	.70
74LS132	.80
74LS133	.50
74LS136	.50
74LS138	1.20
74LS139	.85
74LS151	.75
74LS153	.60
74LS154	1.50
74LS155	1.00
74LS156	1.00
74LS157	.93
74LS158	.70
74LS160	.85
74LS161	.85
74LS162	1.00
74LS163	.85
74LS164	1.30
74LS165	.50
74LS168	1.90
74LS169	1.90
74LS170	2.80
74LS173	.90
74LS174	.90
74LS175	.90
74LS181	2.50
74LS189	3.80
74LS190	1.30
74LS191	1.10
74LS192	.85
74LS193	.85
74LS194	.70
74LS195	.80
74LS196	1.25
74LS197	1.00
74LS221	1.10
74LS245	2.35
74LS2[illegible]7	.90
74LS249	1.30
74LS251	.80
74LS253	.90
74LS257	.65
74LS258	.50
74LS259	2.45
74LS260	.90
74LS266	.90
74LS273	1.60
74LS279	.65
74LS283	1.15
74LS290	1.10
74LS293	1.15
74LS295	1.60
74LS298	1.00
74LS352	1.30
74LS353	1.30
74LS365	.50
74LS366	.70
74LS367	.90
74LS368	.90
74LS373	1.50
74LS374	1.70
74LS386	.50
74LS670	2.70
81LS95	2.10
95H90	11.50
11C90	19.50
81LS96	2.10

81LS97	2.10
TRANSISTORS	
2N301	2.20
2N657	.60
2N930	.60
2N1613	1.10
2N1711	.50
2N1893	1.30
2N2219A	.60
PN2222	.20
PN2222	.30
2N2463	.35
2N2484	.65
2N2646	.70
2N2647	1.10
2N2894	.80
2N2904	.45
2N2905	.40
2N2906	.45
2N2913	1.20
PN2907	.30
2N3053	.60
2N3054	.90
2N3055	.90
2N3301	.40
2N3440	1.10
2N3502	.70
2N3503	.70
2N3563	.30
2N3564	.30
2N3569	.30
PN3565	.30
PN3566	.30
PN3567	.30
2N3568	.30
2N3638	.30
2N3639	.30
2N3640	.30
2N3641	.30
2N3645	.30
PN3642	.30
PN3643	.30
PN3644	.30
2N3646	.30
2N3692	.50
2N3693	.35
2N3702	.30
PN3694	.30
2N3704	.30
2N3709	.30
2N3713	2.20
2N3819	.80
2N3866	2.00
2N3904	.30
2N3906	.30
2N4030	1.10
2N4032	.55
2N4033	.90
2N4036	1.00
2N4037	.90
PN4121	.30
2N4233	1.60
2N4235	1.90
2N4236	2.20
2N4248	.30
PN4249	.30
2N4250	.30
2N4258	.30
2N4292	.70
2N4354	.30
2N4355	.30
2N4356	.30
2N4396	5.00
2N4401	.50
2N4402	.50
2N4403	.50
2N4416	1.00
2N4906	2.80
PN4868	.30
2N5088	.30
2N5089	.30
2N5179	1.90
2N5303	3.30
2N5320	.80
2N5401	.30
2N5458	.70
2N5459	.70
2N5461	.70
2N5484	.70
2N5485	.70
2N5486	.70
2N5769	.30
2N5770	.25
2N5830	.25
2N5831	.30
2N5856	.30
2N5873	1.10

2N5874	1.40
2N5961	.30
2N5963	1.10
2N6027	.60
3N201	.90
AC127	.70
AC128	.70
AC187	.70
AC188	.70
AD149	2.50
AD161	1.70
AD162	1.70
BC318	.30
BC319	.18
BC327	.15
BC328	.30
BC337	.30
BC338	.30
BC547	.15
BC548	.15
BC549	.15
BC549C	.40
BC557	.16
BC558	.16
BC559	.16
BC637	.25
BC638	.36
BC639	.80
BC640	.80
BCY70	.85
BCY71	.85
BD115	1.50
BD135	.70
BD136	.70
BD137	.70
BD138	.70
BD139	.70
BD140	.70
BD235	.65
BD234	.50
BD237	.50
BD262	1.20
BD301	.75
BD302	.75
BD263	1.25
BD435	.75
BD646	1.70
BD647	1.80
BD675	.80
BDV64B	4.50
BDV65B	4.50
BF115	.50
BF173	.70
BF180	.70
BF195	.30
BF198	.30
BF199	.30
BF336	.80
BF337	.80
BF458	.90
BF494	.40
BFX85	.75
BFY50	.90
BFY90	1.30
BSV17	1.00
BU126	3.00
BU208	3.00
BUX80	7.90
FT2955	1.40
FT3055	.75
MEL12	.90
BU326A	3.40
MJ2955	1.00
MJ4032	7.40
MJ802	3.40
MJ4035	6.90
MJ4502	3.70
MJE340	1.20
MJE350	1.70
MJE295	1.90
MJE8055	1.90
MJE3521	.60
MJ15003	4.00
MJ15004	4.00
QF102	.60
MPF131	1.40
MPSA05	.60
MPSA06	.60
MPSA12	.60
MPSA14	.60
MPSA42	.60
MPSA56	.80
MPSA92	.60
MRF475	4.40
TT31B	.90
TI3PIC	1.00
TIP32B	.90

TIP32C	1.00
TIP33A	1.10
TIP34A	1.20
TIP24B	1.50
TIP42B	1.10
TIP110	1.30
TIP120	1.30
TIP2955	1.20
TIP3055	1.20
VN88AF	2.50
MICRO CHIPS	
ADCO 800	12.00
DACO 080	2.00
2012 200 NS	2.00
2102 350 NS	2.00
2102 450 NS	1.40
2102 650 NS	1.40
2111	8.60
2114 150 NS	11.15
2114 300 NS	3.90
2114 450 NS	3.50
8-31	3.30
32 up	3.10
2513	14.50
2516	55.00
2532	69.00
2650	23.00
2708	8.50
2716	12.00
4116	5.50
5101	9.00
MM5204	12.50
MM5220	7.20
MM5307	18.00
MM5309	6.50
MM5312	9.00
MM5369	2.60
5387	8.50
MM5395	6.50
6502	10.50
6508	5.50
6520	5.50
6522	10.00
6523	17.00
6551	17.00
MC6900P	9.00
MC6802	13.60
MC6808	12.50
6810A	4.90
6820	5.50
6821	6.00
6850	5.15
6852	6.40
7106	12.60
7107	15.00
7210	13.20
Z80 CPU	14.00
Z80A CPU	16.00
Z80 P10	13.80
Z80A P10	16.50
Z80 CTC	13.80
Z80A CTC	16.50
Z80 DMA	40.70
Z80 S10 0	56.90
Z80 S10 1	56.90
Z80 S10 2	56.90
Z80A S10 0	63.00
Z80A S10 1	63.00
Z80A S10 2	63.00
8035	27.00
INS8050	15.00
INS8080	8.00
P8085	25.00
8155	22.00
8165	22.00
8205	5.00
P8212	4.00
8214	8.00
8216	5.90
8224N	5.50
8224	7.50
8226	5.90
8228	9.50
8238	8.00
8243	8.00
8251	14.00
INS8251	6.50
8253	19.50
8255A	8.60
8257	99.00
8259	99.00
8275	99.00
8278	99.00

8295	25.00
DM8578	3.50
Ay-5-2376	19.56
8748A	99.00
8755A	99.00
MCT2	.80
MCT6	3.30
MCT275	1.50
MCC671	3.00
4N28	.85
4N33	1.20
4N26	.85
MM80C95	.90
80C96	.90
MM80C97	.90
8098	.90
OPTOCOUPLERS	
MCT2	1.00
MCT6	3.30
MC275	1.50
MCC671	3.00
4N28	1.00
4N33	1.20
4N26	1.00
VOLTAGE REGULATORS	
78L05	.40
LM341P-5	.80
7805	1.00
7905	1.70
LM309K	1.20
7805K	2.10
LM323-K	6.90
78H05KC	8.50
LM341p-8	.80
78L12CP	.40
79L12	.65
LM341P12	.75
7812	1.00
7912	1.90
7812KC	2.15
7912KC	2.60
79H12KC	8.00
78L15	.35
79L15	.65
LM341P15	.80
7815	1.00
7915CT	1.80
7915KC	2.60
78H15KC	6.50
78L18	.35
7818	1.40
78L24	.35
79L24	.65
7824	1.10
LM371T	2.40
LM337T	3.80
LM317K	4.50
LM337K	5.90
LM350K	8.40
78HGKC	10.50
78P05	16.50
BRIDGES	
VM48	1.50
W02	.60
W04	.60
KHPC02	2.00
KBP602	2.50
KBP604	2.60
KBP606	2.80
KHPC1002	2.60
KBPC1004	3.20
KBPC1006	3.20
MDA3501	3.20
MDA3502	3.20
MDA3504	3.40
DISPLAYS	
MAN2A	6.30
MAN72A	2.20
MAN74A	2.20
MAN52A	3.40
MAN82A	3.40
MAN84A	3.40
MAN6740	3.60
MAN8610	3.30
MAN8640	3.30
TIL306	12.00
DL704	2.20
DL707	2.30
DL747	3.40
DL750	4.00
FND357	1.80
FND50C	1.80
FND507	1.80

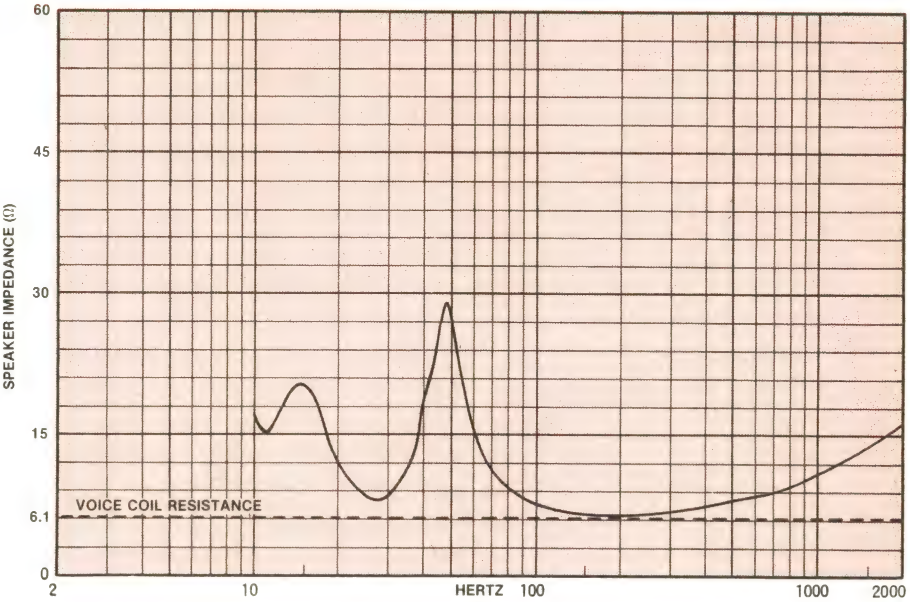
TO ORDER: Heavy items sent Comet Freight on. Mail Order phone 481-1436. Wholesale Customers phone: RITRONICS WHOLESALE 489-7099.
Mail Orders to P.O. 235 Northcote 3070 Minimum P&P $2. Add extra for heavy items, registration and certified mail.
Prices, spec. subject to change without notice.

ther. It may be necessary to fit insulating washers to the mounting screws to avoid shorts between the supply rails and chassis.

Mains power can now be applied and the voltage checks and setting up procedure, outlined last month, carried out.

Finally, the input and output wiring can be installed. The input shielded cables are run from the dual RCA phono socket to the board. Cut and dress the cables so that they lie together neatly, as shown in the photograph. Use cable ties or lacing to hold them in position. There should be no connection between the mains chassis earth and the input cable shields.

On the loudspeaker terminals, connect a .047μF capacitor from the common or "earth" side to the chassis, via a solder lug. This capacitor is visible in the photograph and should be included as a precaution against instability and possible interference which may be picked up by the speaker leads.



The impedance curve is "copybook", with peaks at 15Hz and just below 50Hz corresponding to the two system resonances. Minimum impedance is 6.1Ω.

Setting up

When the sub-woofer enclosure and power amplifier are both complete, final system set-up must be performed. This involves matching the signal level of the sub-woofer to that produced by the main stereo speakers.

Typically, most loudspeaker systems used in domestic stereo set-ups will have a reasonably flat frequency response to below 100Hz. But ideally, for good matching between the sub-woofer and main stereo speakers, the −3dB point of the sub-woofer system, as determined by the input low-pass filter, should match the −3dB rolloff of the main stereo speakers. If you know that your main stereo speakers are reasonably flat to 100Hz and roll off below that, you have no problem.

Alternatively, if you know that your stereo speakers are flat to say, 70Hz, and roll off below that you could change the corner frequency (−3dB) of the sub-woofer amplifier low-pass filter by suitable scaling of the capacitor values.

An alternative method can be used if your stereo amplifier has separate preamplifier outputs and power amplifier inputs. In this case, the signals for the sub-woofer amplifier should be taken from the preamplifier outputs and the bass control set for cut of 3dB at 100Hz, which would be confirmed by measurement at this frequency.

This is done by feeding a 100Hz signal through the stereo amplifier and measuring the output with an AC millivoltmeter or multimeter switched to a low scale. The tone controls are set flat, the signal measured and noted and then the bass control set to reduce the signal level by 30%. This corresponds to a level reduction of −3dB.

Matching the sub-woofer and the main stereo speakers is then adjusted by feeding a 100Hz tone to all speakers and setting the trimpot for equal loudness from sub-woofer and main speakers. Listening tests may then indicate a further small adjustment to obtain good overall balance.

MASTER ELECTRONICS NOW!
The PRACTICAL way!
by SEEING and DOING

This new style course will enable anyone to have a real understanding of electronics by a modern, practical and visual method. No previous knowledge is required, no maths, and an absolute minimum of theory.

You learn the practical, way in easy steps mastering all the essentials of your hobby or to start or further a career in electronics or as a self-employed servicing engineer.

All the training can be carried out in the comfort of your own home and at your own pace. A tutor is available to whom you can write personally at any time, for advice or help during your work. A Certificate is given at the end of every course.

You will do the following:
- Build a modern oscilloscope
- Recognise and handle current electronic components
- Read, draw and understand circuit diagrams
- Carry out 40 experiments on basic electronic circuits used in modern equipment
- Build and use digital electronic circuits and current solid state 'chips'
- Learn how to test and service every type of electronic device used in industry and commerce today. Servicing of radio, T.V., Hi-Fi and microprocessor/computer equipment.

New Job? New Career? New Hobby? Get into **Electronics** Now!

Post coupon now:

The Australian School of Electronics,
PO Box 108, Glen Iris,
Victoria, 3146
A Registered Correspondence College

FREE
COLOUR BROCHURE

Please send your brochure without any obligation to:
Name
Address
Post Code
EA 8/82

It Could Be You!

TELEX MESSAGE TELEX MES

GA
015+
PGM B SYD015

DICKS AA20036

TELEGRAM TO:

CONGRATULATIONS. . . YOU HAVE WON A MAGNIFICENT NEW DATSUN STANZA SEDAN, VALUED AT OVER $7000, IN THE DICK SMITH ELECTRONICS 'WIN A DATSUN STANZA' COMPETITION.

YOUR COUPON WAS DRAWN FROM THE ENTRIES RECEIVED FROM DICK SMITH ELECTRONICS CUSTOMERS WHO HAVE PURCHASED A HOME COMPUTER DURING THE PAST FEW MONTHS.

OBVIOUSLY, ONLY A LIMITED NUMBER OF COMPUTERS COULD BE SOLD DURING THIS PERIOD - SO YOUR CHANCES OF WINNING THE DATSUN STANZA WERE VERY, VERY GOOD.

WITH THE NUMBER OF COMPUTER SUPPLIERS AROUND, DECIDING WHO TO BUY FROM COULD NOT HAVE BEEN EASY. BUT, AS YOU HAVE PROVEN, WHO ELSE OFFERED YOU THE CHANCE TO WIN A DATSUN STANZA?

OF COURSE, WE ALSO GAVE YOU A SEVEN DAY MONEY BACK SATISFACTION GUARANTEE . . . HUGE SOFTWARE BACK-UP . . . TECHNICAL HELP FROM OUR COMPUTER HOTLINE . . . FULL SERVICE FACILITIES WITH FACTORY TRAINED TECHNICIANS . . . AND FRIENDLY , HELPFUL STAFF IN ALL OF OUR STORES READY TO ASSIST YOU.

WITH ALL THIS GOING FOR YOU, IT'S PRETTY OBVIOUS YOU MADE THE RIGHT CHOICE IN COMING TO DICK SMITH ELECTRONICS - AND NOW WINNING THE CAR MAKES IT AN EVEN BETTER CHOICE.

ONCE AGAIN, OUR CONGRATULATIONS - AND MAY YOU BE AS HAPPY WITH YOUR NEW DATSUN STANZA AS WE'RE SURE YOU ARE WITH YOUR NEW COMPUTER FROM DICK SMITH ELECTRONICS.

REGARDS,

DICK SMITH.
DICKS AA20036+

TELEX MES

How would you like to receive this telegram?

The magnificent new Datsun Stanza must be won by a Dick Smith customer in the next few weeks. What a superb Christmas present to receive!

And we're not kidding about your chance to win this superb prize: you've a much better chance of winning this competition than any other competition you could think of!

Every purchaser of a System 80, a Sorcerer or a VIC 20 computer from Dick Smith Electronics will receive a free entry form.* So if you're thinking about buying a computer, hurry and get yours soon: this competition must close shortly.

As well as getting the best in computers, you could be driving a new Datsun Stanza!

See details of these exciting computers in the next three pages.

DICK SMITH ELECTRONICS

*Competition not valid in states where it might contravene State Laws. Permit No TC82/278 issued under the Lotteries and Art Unions Act.

DSE/A313.1/PAI

"Overall, we are very impressed with the Blue Label System 80. On a dollar per function basis it probably represents the best value around for a ready-built computer. Other systems can be bought for less, but ultimately they are not as powerful or as readily expandable as the System 80. There is also the matter of software, and here the System 80 really scores, with hundreds of compatible programs available for the TRS-80 as well as those specially written for the System 80."
Peter Vernon, Electronics Australia June '82

Read what EA have to say!

That's the new SYSTEM 80 BLUE LABEL

with features like:

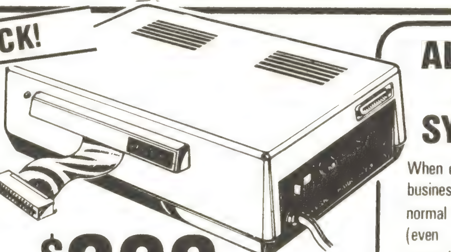
- **16K memory (expandable to 48K with X-4020 Expansion Unit)**
- **Full upper/lower case video display capability**
- **Built-in speaker**
- **Built-in cassette deck with level control**
- **Works with any standard TV set or monitor**
- **Flashing cursor**
- **Huge range of software programs (compatible with most Tandy TRS-80 programs)**

AND LOTS MORE! Cat X-4005

WAS ~~$750~~ NOW ONLY $690

SAVE $60!

NOW BACK IN STOCK!



EXPANSION UNIT

A BRAND NEW MODEL! - now with extra value! The first row of 16K RAM is fitted as standard in this unit, with provision for an extra 16K (making the possibility of a HUGE 48K total memory!) It provides as standard a floppy disk controller capable of controlling up to 4 single density disk drives Significant changes internally include removal of the S-100 motherboard (now available as an option - see below) The Centronics port is still standard, the RS-232C interface and connector are now only available as options (see below) Cat X-4020

$399

16K Expansion Pack

Don't be misled into paying extra for no better quality: ours are the premium quality 200ns type 4116 dynamic RAMS used by most microcomputers. Why not upgrade your computer? Pack of 8 4116 RAMS. Cat X-1186

$29.95

S100 Interface Card

With this card you can open the way to many applications available via the S100 bus system. Cat X-4024

$129.00

RS232C Interface

As an option with the expansion unit, the RS232C interface makes your computer capable of communicating with modems, or driving teleprinters or other serial printers Cat X-4022

$99.00

ALMOST HALF PRICE!

ALSO AVAILABLE DISK BASED SYSTEM 80 Mk II

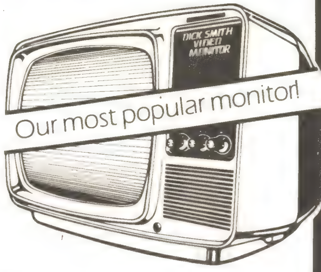
When cassette operation is too slow and cumbersome for business operation, then this System 80 is the answer. The normal in-built cassette mechanism has been removed (even though we've allowed for external cassette connection) to allow for connection to a disk drive. We also added numeric keypad for extra fast finger input, and a special ROM program to allow for a flashing cursor on the screen for instant position recognition. Plus lots, lots more! Why not check it out at your nearest store right away! Cat X-4100.

ORIGINALLY ~~$1495~~ NOW ONLY $750

ECONOMY GREEN PHOSPHOR MONITOR

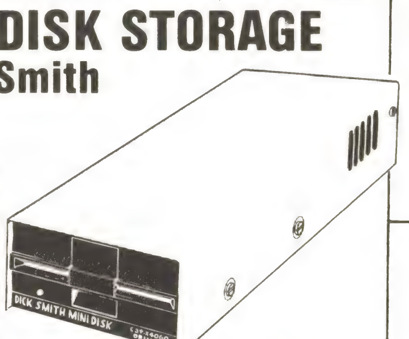
If you're seriously into computers then this is the monitor for you. Provides a sharper, brighter image, and you avoid eye fatigue! Suited more for the professional rather than the hobbyist! Cat X-1198.

ONLY $199



Our most popular monitor!

BARGAIN DISK STORAGE with the Dick Smith DISK DRIVES



Our disk drives go much further ... for so much less! They cost so much less than the Tandy Disk Drives and they incorporate a high quality MPI B51 drive mechanism together with matching inbuilt 240V power supply. Each drive has 40 track of storage capacity and is suitable for both double and single density recording. (With double density recording you can store more than 180K bytes per diskette!) They are suitable for use with most computers and disk controllers using the 34-way connection bus - such as the System 80 or TRS-80. (Don't pay their prices for disk storage!)

ONLY $419

Already configured for the two drives most users need: drive 0 (Cat X-4060) and drive 1 (Cat X-4061).

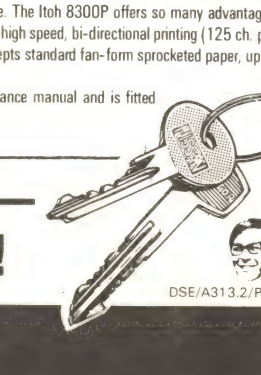
DOT MATRIX PRINTER

ONLY $799

WAS ~~$970~~

SAVE $170!

We've sold more of these superb printers than any other type. The Itoh 8300P offers so many advantages over its competitors ... not the least being the price! It features high speed, bi-directional printing (125 ch. per second) with a full upper and lower case character set. It accepts standard fan-form sprocketed paper, up to 240mm size (minimum 115mm) and so much more!
Each printer is supplied with a technical manual, a maintenance manual and is fitted with the standard 57N-36 input connector. Cat X-3255



AND YOU COULD WIN A DATSUN STANZA — BUT ONLY FROM DICK SMITH ELECTRONICS!

DSE/A313.2/PAI

VIC-20 COLOUR COMPUTER

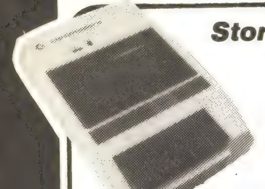
Ideal for the first time user, this remarkable computer can be used immediately with plug in cartridges. The fantastic range of game cartridges can be used with any colour or B & W TV set, to look just like the arcade games. Or it can be expanded to form the heart of a complex computer system. The system is programmed in BASIC and "........*provides good value for money*........". **(EA, July 82 Pp 114)**

ONLY $399 **Cat X-2000**

Also available:

Colour monitor to suit VIC 20, Cat X-1195	**$379.00**
B & W Monitor to suit VIC 20, Cat X-1196	**$149.50**

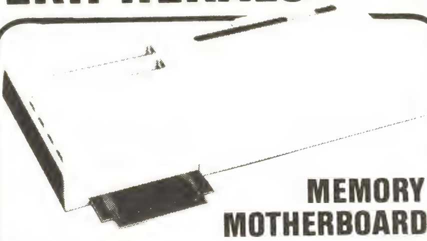
GENUINE VIC 20 PERIPHERALS



Store your programs
DATASETTE

only $99⁰⁰

This remarkable computer comes equipped with a tape cassette interface which lets you connect the Commodore tape unit directly into the computer. With this ability you can load, store or retrieve data on standard cassette tape. By a simple command the machine will automatically 'save' a full program for you. It's a handy and economical way of storing and retrieving data, plus you can buy existing software or create your own programs and store them. Cat X-2005.

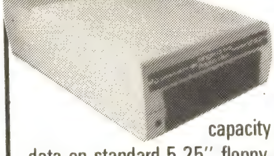


MEMORY MOTHERBOARD

Now you can connect up to 6 different expansion programs at the same time. Increase your computer's capabilities to its maximum of 32K plus connect interface cartridges as well. Cat X-2011.

ONLY $199

FLOPPY DISK DRIVE



ONLY $699

Fast, high capacity storage/retrieval of data on standard 5.25" floppy diskettes. Stores up to 170K on each diskette, with read/write compatibility with PET/CBM Computer Systems. Comes complete with own power supply. Cat X-2007

GRAPHIC PRINTER

ONLY $479

Economical dot matrix printer makes paper copies of BASIC programs, letters, business data and graphic displays. Connects directly to the VIC 20, prints all characters incl. letters, numbers and graphics. Reliable tractor feed mechanism. Accepts sprocketed 8 inch roll or sheet paper. Unique uni-hammer print head for improved reliability. Cat X-2009.

WANT TO KNOW MORE?

Introduction to Computing
Sample programs in the book and on tape make this an interesting introduction for the non-computerist. Cat B-2001 ... **$29.95**

Introduction to Basic
A gentle but thorough introduction to BASIC programming. Instructional tapes are supplied. Cat B-2002 .... **$29.95**

Personal Computing on the VIC 20
The 'friendliest' computer guide available. This manual comes free with every VIC 20 but is also for sale separately due to the high demand. Cat B-2003 .... **$12.00**

(All books written especially for the VIC 20)

JOYSTICK

Allows 4 way movement. Play against the computer as in the popular arcade type game 'Space-Invaders'. Cat X-2020

ONLY $19⁹⁰ ea

PADDLES

For two player games such as 'Tennis'. Small and compact they allow movement left or right and are easy to fire with. Cat X-2022 **$39⁵⁰ pr**

AND LOOK AT THE GREAT PROGRAM RANGE

ON PLUG-IN CARTRIDGE

Super Alien
Can you capture the aliens before they zap you?
Cat X-2051 .... **$39.95**

Draw Poker
Casino style poker recreates the real thing!
Cat X-2053 .... **$39.95**

Rat Race
Race through a maze. Challenging game of action, requiring quick thinking.
Cat X-2055 .... **$39.95**

VIC Avengers
Space action for arcade enthusiasts. You are the VIC Avenger protecting the Earth from an invasion of space intruders.
Cat X-2048 .... **$39.95**

Superslot
Colourful slot machine, works just like the real thing! Cat X-2049 .... **$39.95**

Midnight Drive
Authentic night drive simulation provides chills and ... spills? An unusual computer challenge.
Cat X-2054 .... **$39.95**

Jelly Monsters
Jelly Monsters abound in a maze, racing at you, following your every move. Look out!
Cat X-2050 .... **$39.95**

Super Lander
Pilot your Jupiter Lander through the treacherous crevices of a mysterious planet.
Cat X-2052 .... **$39.95**

ON CASSETTE

Car Chase
Fast paced road action
Cat X-2031 .... **$14.00**

VIC 21 Casino Game
Casino style blackjack
Cat X-2032 .... **$14.00**

Biorythym
Compare biorythym compatibility
Cat X-2034 .... **$14.00**

Slither/Super Slither
Dexterity game.
Cat X-2036 .... **$14.00**

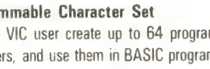
Blue Meanies
Space game. Watch out, they'll get you!
Cat X-2033 .... **$14.00**

Space Math
Maths improvement. Learn at home!
Cat X-2035 .... **$14.00**

Recreation Pack
Contains all of the above cassette programs in a six pack. Cat X-2037.
.... **$75.00**

Programmable Character Set
Lets the VIC user create up to 64 programmable characters, and use them in BASIC programs. The Editor takes only one half kilo-byte of program space, works with tape, disk and printer.
Cat X-2045 .... **$29.95**

AND YOU COULD WIN A DATSUN STANZA – BUT ONLY FROM DICK SMITH ELECTRONICS!



DSE/A313.3/PAI

I.B.M., Digital and other industry giants have gone the CP/M way!

YOU CAN TOO WITH THE BRILLIANT SORCERER!

Some of the world's leading computer manufacturers are now producing CP/M based systems to utilise the vast range of existing software. The only problems for you are 1): Some of the CP/M-based systems are not yet available in Australia, and 2): Some of them may cost up to, and over, $5,000! So why not check out ...

The Incredible Sorcerer

For the serious personal computer user, it offers a truly outstanding performance - plus the ability to run the industry-standard CP/M operating system at lower cost than any other computer. The Exidy Sorcerer MkII — the most powerful, flexible and businesslike machine in its class.

Look at the features

- Built in serial and parallel ports
- 2 cassette control ports
- Powerful graphics capabilities
- Expandable to 48K on board
- Uniquely versatile ROMPACS™ — instant change to dedicated processor, and back again!
- Built-in 4K ROM resident monitor
- Economic disk storage now available (optional) with Exidy's FDS — floppy disk subsystem (does not need expansion interface)
- 8K Microsoft BASIC

Cat X-3002

VIDEO MONITOR, FDS & SOFTWARE MANUAL NOT INCLUDED IN PRICE OF COMPUTER

OUR BETTER BUYING POSITION MEANS WE CAN PASS ON THE SAVINGS TO YOU!!

SAVE NEARLY $200

was ~~$1398~~

NOW ONLY **$1195!**

SAVE $100's FDS Disk Drive doesn't need an expansion unit!

The FDS Disk Drive comes with CP/M as standard. It has a storage capacity of 308K Bytes and has its own controller system and logic to run itself and up to two other drives! Add it to your Sorcerer and you have the lowest cost CP/M system available in Australia.

Cat X-3220

and it's only

$1290

GREAT NEW SOFTWARE ON TAPE

ZAP 80

'Secret Code Disassembler' - it will display all those unknown instructions Zilog never talk about!

Cat X-3625 .... $^{\$}22^{95}$

FORTH

Forth is a new language for your Sorcerer using postfix notation (RPN).

Cat X-3629 .... $^{\$}47^{95}$

DUMB TERMINAL vs. 3

Enables your Sorcerer to be used as a low cost, user configured communications terminal.

Cat X-3637 .... $^{\$}7^{95}$

COPYFILE

A disk to file transfer program essential for the single drive CP/M user. Automatically loads itself onto your disk.

Cat X-3714 .... $^{\$}24^{50}$

& MANY MORE

UTILITIES ON DISK

EDOS

Adds disk operating commands and many enhancements to ROMPAC™ BASIC. Requires X-3205 Disk System.

Cat X-3602 .... $^{\$}47^{00}$

EXTENDED BASIC FOR FDS

Features include double precision variables, constants, maths, full line editing and all normal disk facilities and commands.

Cat X-3712 .... $^{\$}473^{00}$

DSKCITOH/PRINT (FDS)

Soft sectored disk driver and proportional print driver to be used with the FDS and the word processor ROM PAC

Cat X-3726 .... $^{\$}155^{00}$

ASK FOR OUR FREE SORCERER BROCHURE

DICK SMITH ELECTRONICS

SEE PAGE 124 FOR STORE ADDRESS DETAILS.

DSE/A236M/PAI

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

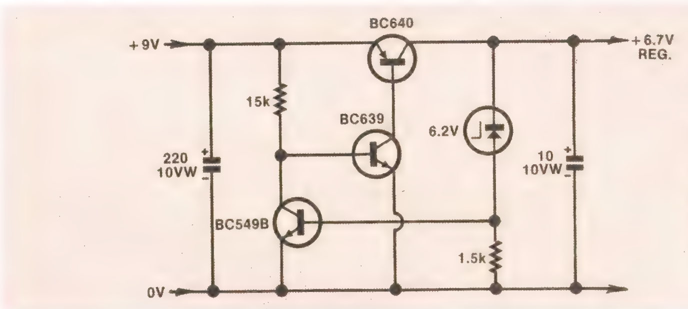
Regulated Supply for Flash Meter

Experience with the EA Electronic Flash Meter (Jan 1980) has revealed some minor limitations. The main one is that the calibrations can vary markedly with battery voltage, especially at the lower meter readings. This can be overcome by using a stabilised supply.

The circuit shown requires little current to operate and functions satisfactorily with battery voltages as little as 0.3 to 0.4V above the regulated output. It is easily built on a small piece of matrix or Vero board, and the layout is not critical. The new board can be glued to the lower edge of the original board, at right angles to it.

Apart from the obvious wiring changes to insert the regulator in the positive supply line, the original 1000μF capacitor was replaced with a 220μF unit. Also, the battery test position of the three position switch now connects the meter to the regulated supply rail, rather than the battery. It is suggested that the calibration resistor (originally 100kΩ) be modified to give a reading of "9".

Heavy duty batteries, such as alkaline-manganese or nicad are preferred for this circuit. The regulator circuit causes a heavy switch-on surge and zinc-chloride batteries cannot supply this when they age a little. This causes the regulator to latch-up (Q2 and Q3 act like an SCR) and draw 100mA or more.



This circuit provides a stabilised power supply for the Electronic Flash Meter (Jan 1980).

With the battery test position wired as above, a failure to get a "9" reading indicates that the voltage regulator has not functioned, probably due to battery failure. Switch off immediately and investigate.

The exposure meter should be recalibrated after these changes. It is necessary to reduce the 22kΩ resistor, in series with the 22kΩ trimpot, to 6.8kΩ to bring calibration to the mid-range of the trimpot.

A second modification is to fit a diffuser over the cell to reduce its directional sensitivity and improve its performance with multiple flash set-ups. This can be two squares of translucent plastic cut from a Kodak slide box.

G. W. Ford,
Horsham, Vic.

(Editorial note: The need for a heavy duty battery to "start" the regulator is a disadvantage. It may be possible to overcome this by inserting a suitable value resistor in series with Q2's collector.)

Playmaster Tone Control Bypass

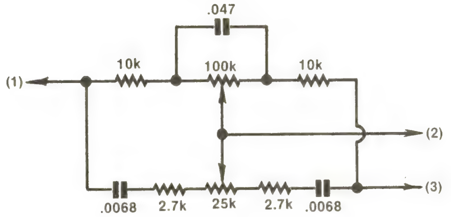


Fig. 1

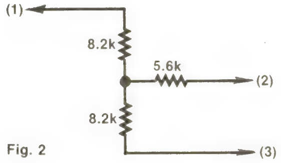


Fig. 2

The audiophile purist who wishes to bypass the tone control network of recent Playmaster amplifiers may do so by replacing the reactive network by a resistive network which has the same impedance at 1kHz.

Fig. 1 of the accompanying diagram features the main components in the tone control network but not including the two 0.47μF DC blocking capacitors. Fig. 2 is the equivalent resistive network at 1kHz.

Readers may also be interested to know that changing the 2.2kΩ emitter resistor for the bootstrapped transistor (Q4) in the tone control circuit to 2.7kΩ gives a better quiescent point and hence, more symmetrical clipping.

L. Murakami,
West Beach, SA.

(Editor's note: Since we have not tried this circuit we cannot state whether the bypass condition would yield a flatter frequency response from the amplifier than if the tone controls were set for their "flattest" condition.

Note also that a six-pole, two-position switch would be required and additional components may be necessary to prevent loud switching transients from the speakers when the switch is operated.)

Computer as a Pattern Generator

Have you ever wished for a pattern generator to adjust your TV set for optimum linearity, convergence, etc? If you have a personal computer, then you have a TV pattern generator, even if you didn't realise it. All personal computers with an RF modulator output can be used as TV pattern generators.

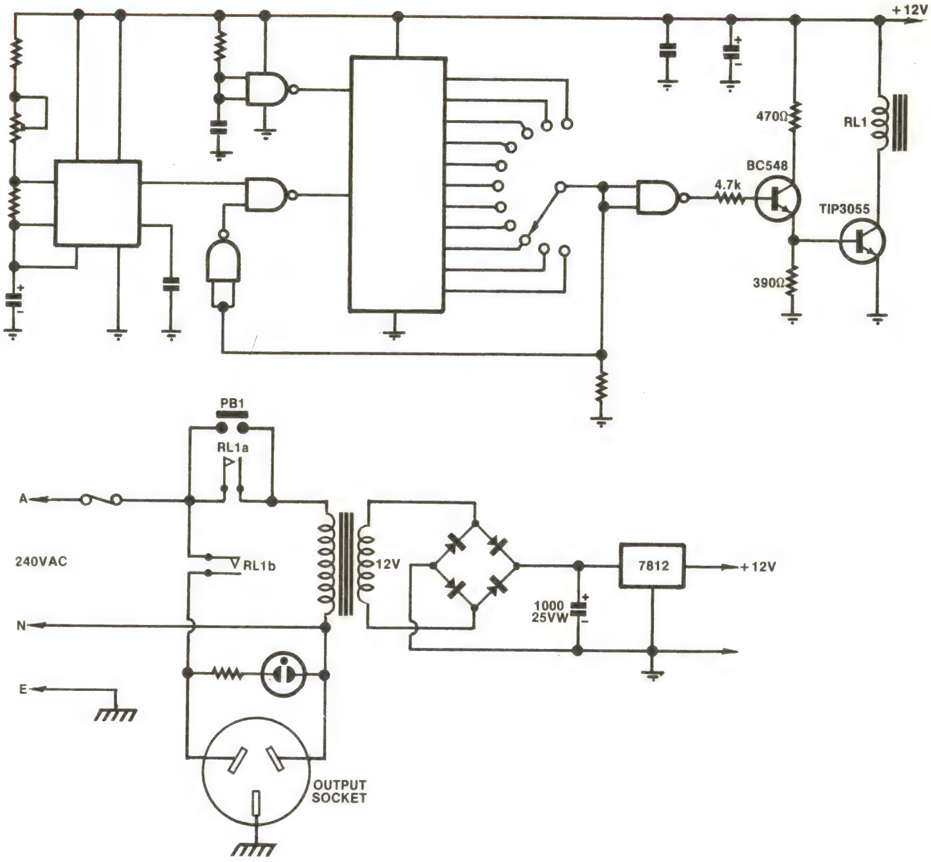
The best are obviously those with full graphics and colour display facilities. These computers can be made to simulate nearly all the patterns obtainable from a commercial TV test pattern generator (dots, crosshatch, checkerboard, colour bars and so on).

Even the simplest computers with no graphics capabilities can provide some useful patterns for TV alignment.

So next time you need a TV test pattern generator remember your computer. Another victory for the general purpose machine over the special purpose one!

D. L. Craig,
Holland Park, Qld.

Four Hour Photographic Timer



This circuit satisfies the need for a four-hour timer to switch off a photographic battery charger and involves modifications to the Ultility Timer published in August 1978. The BC558 (PNP) was replaced with a BC548 (NPN) and, with the 470Ω and 390Ω resistors in the collector and emitter circuits, it biases the TIP3055 power transistor on, to activate the 12V relay. When the output of the 4020 goes high, after the chosen period, the relay drops out. Otherwise the circuit remains as published, except that the supply voltage is raised to 12V.

The power supply is a standard 12V circuit with regulator. The relay has two sets of contacts. One, RL1b, switches the active line to the output socket, across which is placed a neon indicator lamp. The other relay contacts, RL1a, control the power supply. PB1 is a momentary-on pushbutton switch.

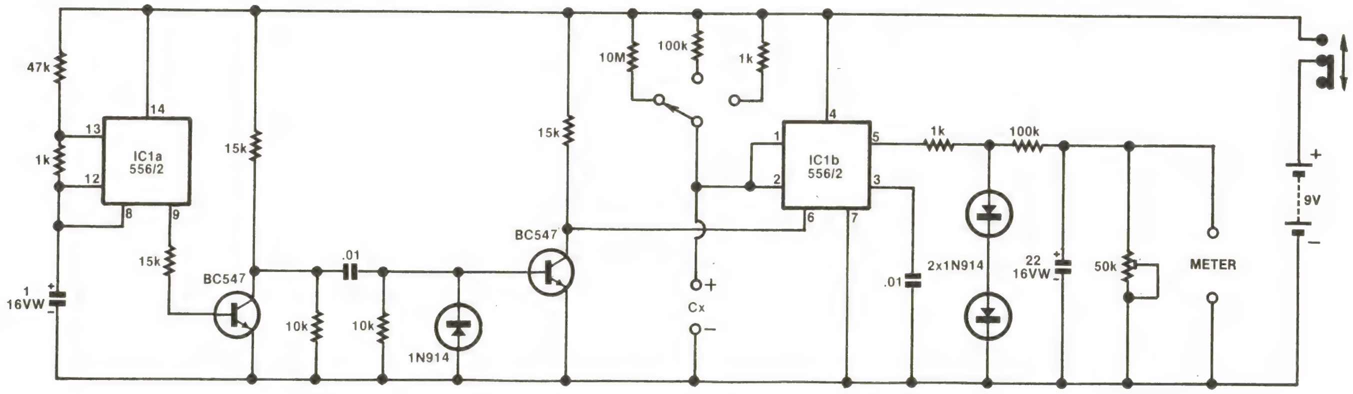
(Editorial note: In the interest of safety, both sets of relay contacts and the pushbutton switch would have to be rated for connection to the 240V mains.)

When the push-button is pushed on, it bypasses RL1a, and supplies current to the transformer primary, and hence to the power supply. When the timer circuit is activated, the base of the BC548 goes high and switches on the relay via TIP3055. Once the relay switches on, shown by the indicator lamp, the push-button switch can be released.

At the end of the selected timer period the relay will switch off, cutting power not only to the output socket, but also to the unit itself. So when the unit is not in operation, it will draw no power at all.

P. E. O'Connell,
Oatley, NSW.

Use your DVM as a Capacitance Meter



This adaptation of the "3½-Digit LCD Capacitance Meter" circuit uses a digital multimeter, set on the 200mV scale, instead of the LCD module and replaces the 7555 with a 556 IC. Alternatively two 555s or two 7555s could be used.

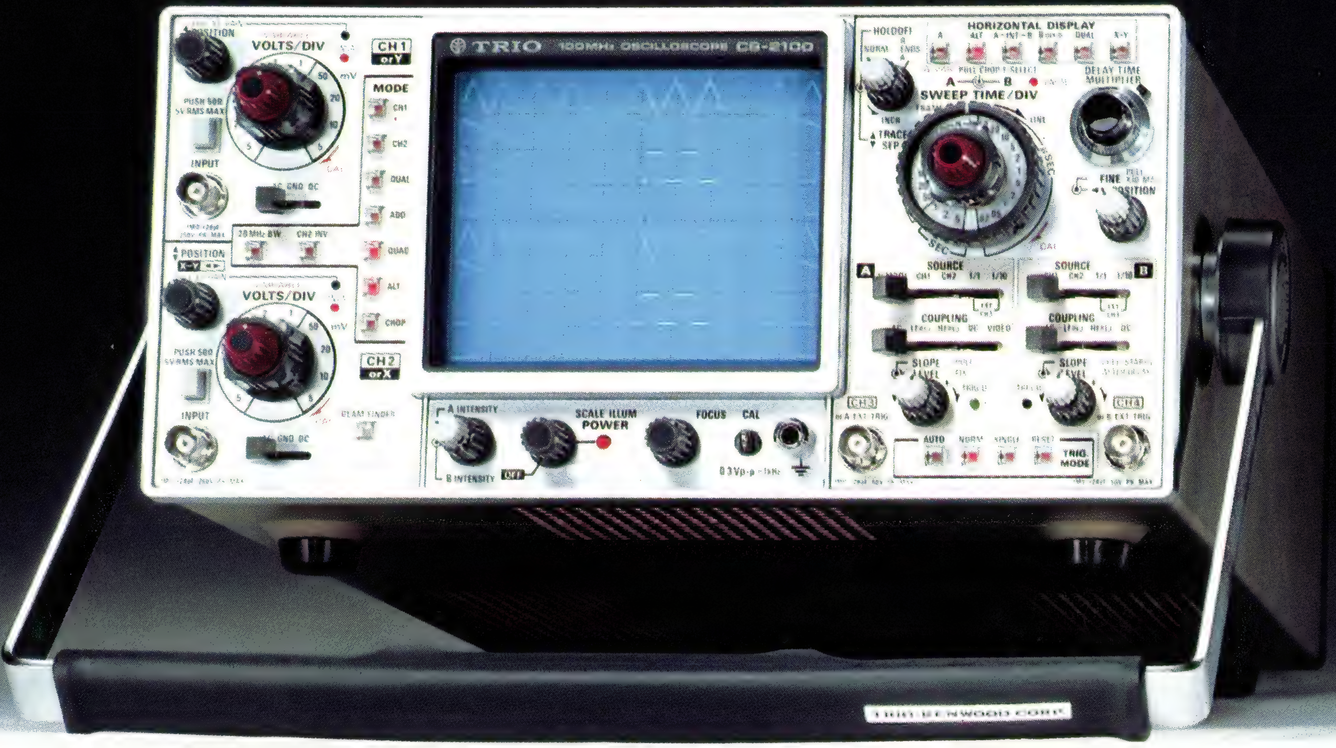
One half of the 556 IC, IC1b, is used as a monostable in the same manner as the original circuit. The other half, IC1a, is connected as an astable multivibrator and replaces the backplane signal from the LCD module.

To calibrate the meter the 200nF range is used. It is necessary to note the initial reading and then connect a capacitor of known value and within the 200nF range. The trimpot is then adjusted until the reading is equal to the sum of the initial reading and the known value of the capacitor. In subsequent use the initial reading is subtracted from the meter reading to give a true value. There is no offset adjustment.

Since the ranges are the same as in the original project, it is also necessary to multiply the final reading by 10 on the pF range and to divide by 10 on the μF range.

G. Freeman,
Kellys Plains, NSW.

Performance Unmatched by Oscilloscopes Costing up to $1,000 More



100 MHz 4 CHANNEL/8 TRACE

TRIO, already famous for providing solutions to the tough problems of oscilloscope users throughout the world has developed an instrument destined to rewrite oscilloscope history. The CS-2100 provides a host of powerful features in a truly compact 100MHz scope.

In addition to all the frequency response that you probably will ever need, the CS-2100 makes use of TRIO's unique oscilloscope expertise in the form of such features as alternate, delayed and dual sweep, separate delayed sweep intensity control capability and selectable input impedances, making the CS-2100 the scope you were hoping would be introduced in a year or so.

Words and space fail us here for a complete description of the CS-2100's capabilities. You will need to request our brochure — but be prepared to be impressed.

Don't Accept Second Best, Insist on TRIO!

PARAMETERS PTY LTD

PERFECTION IN MEASUREMENT

Sydney: (02) 439 3288 Melbourne: (03) 580 7444

THE BEST KIND OF JOB I

Job satisfaction means fitting the right man to the right job. It's obvious really. If you like doing it, you're likely to do it better.

If you'd enjoy working with electrical equipment, or radio equipment, jet or marine engines and you meet the entry requirements, it's very likely there's a good job waiting for you in the Navy.

The Navy has a long history of discovering great talent in young people. So if you know you've got a lot to offer, but you're not quite sure what it is, a good chat with a Navy Careers Counsellor is just what you need. You may both uncover a great new talent, and that would be something to be proud of. Pick up a phone now, or send the coupon.

IF YOU ARE UNDER 17, BUT OVER 15, ENQUIRE ABOUT OUR APPRENTICESHIP AND JUNIOR RECRUIT SCHEMES.

Authorised by Director General Recruiting Dept. of Defence

S THE JOB YOU DO BEST.

N.S.W.: Sydney 212 1011, Parramatta 635 1511, Newcastle 2 5476, Wollongong 28 6492. VIC: Melbourne 61 3731, Geelong 21 1588. QLD: Brisbane 226 2626, Townsville 72 4566. S.A.: Adelaide 212 1455. W.A.: Perth 325 6222. TAS: Hobart 34 7077, Launceston 31 1055. A.C.T.: Canberra 82 2333.

To: Navy Careers Counsellor, G.P.O. Box XYZ...(your Capital City and Postcode)
Please send me more information about joining the Navy.
Name __________ Date of Birth __________
Address __________ P/Code __________
☐ General Entry (17-26) on entry. ☐ Junior Recruits (15¾-16½) on entry.
☐ Apprentices (15-17½) on entry. Tick the information box that interests you.

NAVY

THE PRIDE OF THE FLEET IS YOU.

NGE 48 DPS 32

Exclusive to Marantz.
Very sophisticated. Very superior. Very expensive.

Very high fi indeed.

These Marantz Gold components represent the world's most advanced, most inspired, most stringently tested and sophisticatedly engineered audio equipment.

For the wealthy—exclusive toys.

For the connoisseur — the finest hi-fi money can buy.

The Marantz TT1000 (around $2500), with its precision-made high density glass and golden aluminium sandwich structure, is justifiably described as one of the most beautiful turntables ever.

'Playing a series of direct-recorded discs, warped discs, discs with nasty low frequency content and discs requiring unusual trackability performance, showed clearly that this system borders on the superlative in areas where even most good turntables only provide good to above average performance.'

SM1000

'. . .the resonance characteristics of the TT1000 are the lowest we have yet seen from any turntable irrespective of its selling price.'

'This is top-of-the-line equipment for people who rate hi-fi as their greatest pleasure in life'. — *Louis Challis, Electronics Today International, April 1981.*

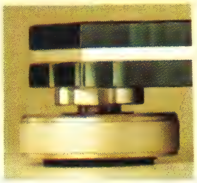
Similarly, the Marantz SM1000 Stereo Amplifier (around $5000) is designed to be the ultimate in luxury and performance.

When it was bench-tested by ETI Magazine in an exhaustive lab study, Louis Challis stated 'The Marantz SM1000 Amplifier has the capability to provide superlative performance at home, in a laboratory, in a studio, or in a rock band with the ease and panache of a professional.

'The power output claims are modest for the unit is readily capable of producing 625 watts into an 8 ohm load with both channels driven . . .'.

And when the Marantz ST8 FM/AM Tuner (around $700) was put through its paces so technically surprising was its performance that a second series of tests was devised to check the first results.

'As a result . . . the Marantz ST8 . . .far ahead of any tuner we have ever measured and better than any tuner we have ever seen reviewed in any other magazine, either local or overseas.' — *Paul de Noskowski, Electronics Australia, April 1981.*



The TT1000's adjustable, high-absorption air suspension audio insulator feet.

Marantz Gold.
The New Audio Standard.

ST8

Detailed specifications of these exclusive Marantz Gold components are available on request by writing to:

Marantz (Australia) Pty. Limited,
19 Chard Road, Brookvale, NSW 2100
Phone (02) 939 1900 Telex AA24121
Melbourne (03) 544 2011
Brisbane (07) 44 6477
Adelaide (08) 223 2699
Perth (09) 276 3706
Townsville (077) 72 2011

marantz®

The Serviceman

Just when I thought I knew all the tricks!

My main story this month relates to one of the most frustrating service experiences I have had for a long time. What made it all the more infuriating was that it involved a set which has been around for many years, and about which I blissfully imagined I knew all the tricks.

The set was one of the Decca 33 series, a hybrid model using solid state devices for most functions, but with valves in the heavier duty sections of the line and frame circuits. By and large they have proved very reliable, most of the failures being due to sick valves, which serve to remind us just what a weak link these devices were in the old days of monochrome TV.

The story started with a phone call from the owner to my home early one evening. Since he was as much a friend as a customer, I didn't really mind, provided he didn't expect me to dash around to his home right away. He didn't, as it transpired, but he did have a problem.

It seemed that he wanted to watch a particular program later in the evening, and the picture had suddenly started to roll. As a short term measure he wanted to adjust the vertical hold control in the hope that he could stabilise the picture for a few hours. Longer term he assumed he would have to have the set serviced.

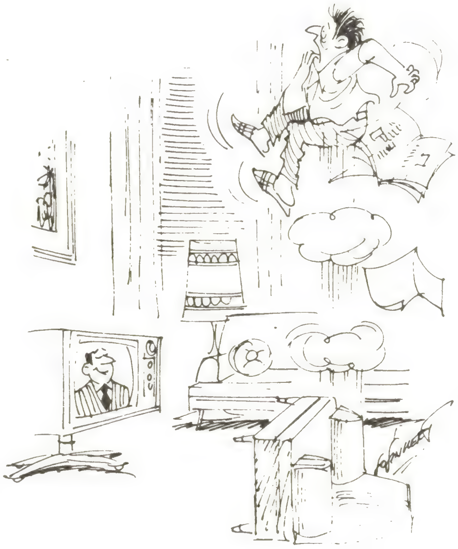
NO VERTICAL HOLD?

But his immediate problem was that he couldn't find the vertical hold control, and had rung me in desperation. Unfortunately I couldn't help him, because there is no such control on this set; a piece of news which he didn't receive too happily.

Fortunately, I was still able to offer some help. It is my experience that most rolling faults in this model tend to be temperature sensitive; most likely to occur after the set has been running for some time as, I gathered, was so in this case. I suggested that he switch set off immediately and let it cool for the next hour or so until his program was scheduled. With luck, it might just work.

And that was the last I heard about the set for the next three weeks. In fact, I had forgotten all about it when the next phone call came along. It seemed that my original trick had worked and, strangely enough, the set had more or less behaved itself ever since, with just an occasional flip. But now it had completely run amok, rolling continuously, whether it was hot or cold.

So I duly called at the house and, for once, the set behaved for me just as it had for the customer; it rolled continuously. This is not an uncommon fault in this set, and is most often due to a sick PL508 valve in the frame output stage. In fact, I had gone in armed with a replacement valve.



"That siren was a test. We wanted to determine whether you were awake and watching our program." (Radio-Electronics.)

It took only a moment to swap the valves and, when the picture came up again, it was rock steady. So that was that. I spent a few minutes making routine adjustments to height, linearity, etc, then began to pack up and prepare to leave. And guess what? No prizes; it rolled again!

Even then I was only mildly concerned. The next most likely culprit was the PCF80, a triode pentode, the triode portion of which is used as one half of a multivibrator circuit, with the PL508 frame output valve as the other half. It is a somewhat unusual arrangement, but one that normally works very well.

So I tried a new PCF80, which made no difference whatsoever. But I was still convinced that it must be a valve problem and fetched another PL508 from the van on the off chance that my replacement might have been faulty. But I was really clutching at straws and, when this effort failed, I realised that I couldn't play valve jockey any more. I also realised that it was no longer a house-call job; it would have to go into hospital — sorry, the workshop.

And need I add that, having set it up on the bench, it stubbornly refused to roll? Well, its true, even if you've heard it all before. But not for long. After it had been running for a while it started to roll again, suggesting that my original heat sensitive theory was correct.

At this point I couldn't be sure whether I had a frame oscillator fault, or a sync fault. Since it wasn't either valve in the oscillator circuit, I was tempted to suspect the sync but, on the other hand, there was no suggestion of line sync failure.

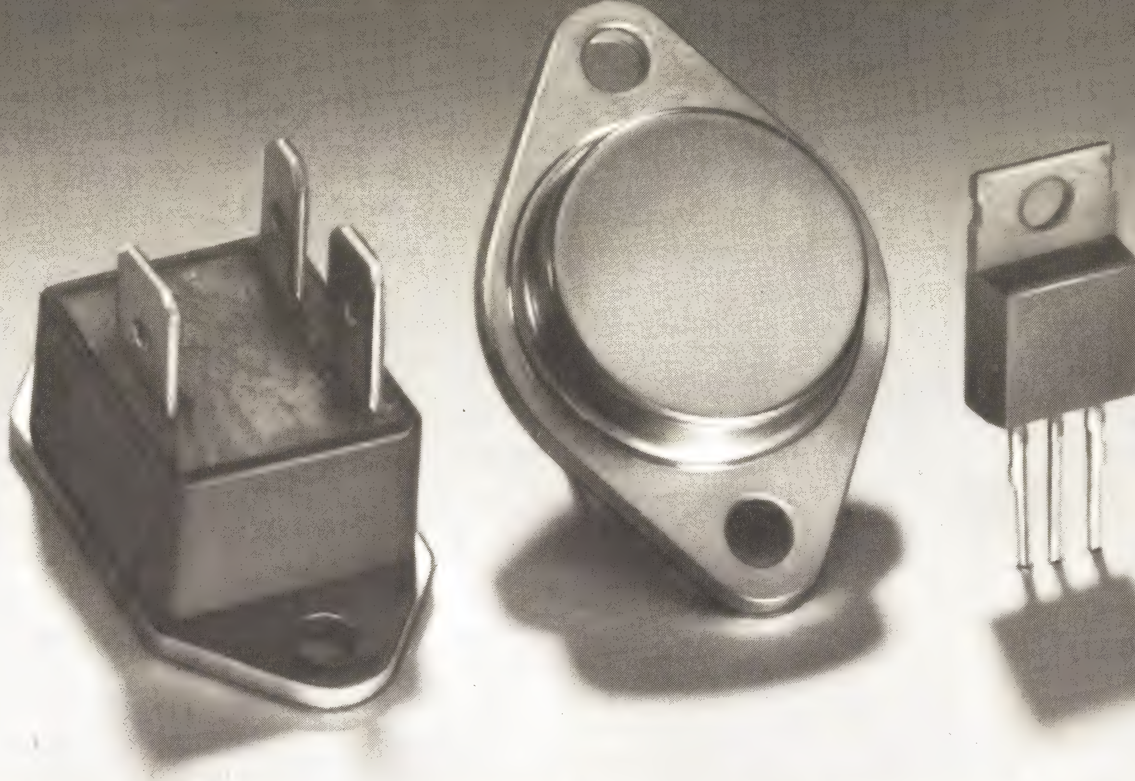
OUT WITH THE CRO

I stoked up the CRO and hooked it onto TP (Test Point) 201, the output of the first sync separator stage. Unfortunately, although designated as a test point, the circuit diagram gives no waveform pattern for it. But the pattern I observed was clean enough and appeared to be of reasonable amplitude for that part of the circuit.

From here the sync pulses go to a se-

Make the Switch to GTO + Power MOS

Philips Powerful Partners



Now the choice in power semi-conductors for switching applications is easy with Philips complementary range of GTOs (gate turn off switches) and MOS FETS known as Power MOS. Together they cover the complete spectrum of power switching applications up to 1500 Volts and 50 Amps.

GTOs will be used mainly for higher voltage applications. Like the thyristor, GTOs can be turned on by positive gate drive and like high voltage transistors, can be turned off by negative gate drive…the best of both worlds.

The new Power MOS transistors are electrically and thermally very rugged, while their construction intrinsically means very fast turn-on and turn-off times…typically 100ns.

Other Power MOS features include:

- Direct drive from TTL/LSI plus μC output ports.
- Optimum reliability via outstanding SOAR characteristics.
- Easy parallel operation.
- High power amplification.

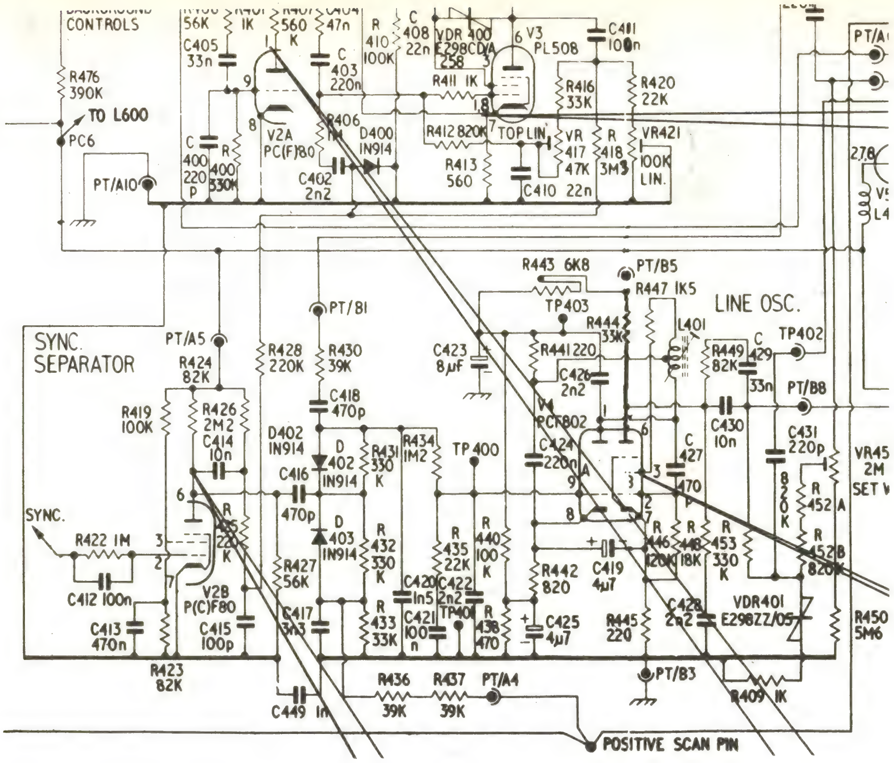
We can help you make the perfect switch. Simply contact your local Philips Components office for further detailed information on GTOs and Power MOS.

Call **Sydney** 427 0888,
Melbourne 542 3333,
Brisbane 44 0191,
Adelaide 243 0155,
Perth 277 4199.

Electronic Components and Materials

PHILIPS

AHEARN EL58



Frame oscillator and sync separator stages of the Decca 33 receiver. C415 had gone low in value, reducing the amplitude of the sync pulses.

cond sync separator stage, which is the pentode section of the previously mentioned PCF80. As well as providing additional amplification, it is in the output circuit of this stage that the horizontal and vertical pulses are separated and the vertical pulses suitably integrated.

I was just contemplating which part of this circuit to check when the rolling suddenly stopped. This seemed to provide a good opportunity to observe some waveforms while the set was normal, against the next time it failed. Again this circuit falls down rather badly in the matter of waveforms, at least in regard to the ones I wanted.

The only waveform shown is that at the output of the PCF80 pentode, and that is for the line pulses only. The frame pulses cannot be readily observed until they have been integrated by an RC network consisting of a 2.2MΩ resistor (R426), a 220kΩ resistor (R425), a .01μF capacitor (C414), and a 100pF capacitor (C415).

From the junction of R425 and C415 a vertical sync pulse line is taken to the vertical oscillator multivibrator circuit, via a 220kΩ resistor, R428. I checked the waveform on the oscillator side of R428 and observed what appeared to be a classic waveform; the sync pulse was clearly visible, as was the vertical oscillator pulse, the one sitting on top of the other and, firmly locked together.

The next time the picture rolled I checked this and other waveforms again. But I didn't seem to be getting anywhere. Both the frame pulses and the sync pulses appeared to be the same, except that they were no longer locked together. If there were any other differences, they were too subtle for me to see.

On the other hand, the temperature sensitivity of the fault appeared to be fairly consistent, and it seemed likely that the fault might respond to some freezer spray. In particular I suspected the integrating components I have already mentioned, plus R406, C404, and diode D400. As well as being in the vital part of the circuit, they are all mounted quite close to the PCF80 and can absorb heat from it.

THE OLD FREEZER TRICK

So I began a systematic routine of spraying these components whenever the picture rolled. And I seemed to be getting somewhere, because blanket spraying did cure the fault. Then I began to narrow it down, and, eventually, I settled on C402, a 2200pF capacitor. Every time I sprayed it the rolling stopped and held for some time afterwards.

So out it came and in went a new one. And that fixed it. I ran the set for several more days in the workshop, putting it through many hot and cold cycles, and it never missed a beat. So I took it back to the customer, collected my fee, and everyone was happy.

For about 10 days, that is. Then the customer was on the phone complaining, somewhat apologetically, that the picture was rolling again. And, he added, it now seemed to be worse than ever.

I'm afraid that really rocked me. No one likes having a set bounce; it tends to shatter the ego, and it can also shatter one's reputation. Fortunately, this customer knew me well enough to accept the situation, but that didn't alter the fact that a lengthy exercise on my part, and one about which I had felt so confident, had suddenly blown up in my face.

I lost no time in getting the set back into the workshop and setting it up. And it behaved exactly as the owner had said; rolling virtually continuously. In fact, that was the only bright spot in the whole nasty business; the fact that it was no longer intermittent.

To start things rolling I decided to have another go with the freezer spray, hoping against hope that there might have been two temperature sensitive components. But it was a wasted effort, no amount of spraying had any effect at all.

So what now? I hooked the CRO into the junction of C402 and D400 and watched the sync pulse float along the vertical oscillator pulses with absolutely no sign of locking. Otherwise I couldn't detect any difference between the waveform now and when the system was locked.

Then I had another idea. Could it be that the multivibrator's free running speed had drifted, due to component drift, and was now so far off that it wouldn't lock? It was a good thought, the only trouble being that I had no idea just how tolerant this particular circuit was in this regard.

As a first step, I removed the sync pulses by lifting the 220kΩ resistor, R428. Then I went over the multivibrator circuit and checked or replaced every component likely to effect the free running frequency. These included R407 and R408, and C405 and C403. The capacitors were checked on the bridge and found to be OK, so were re-fitted. The two resistors were marginally high, and were replaced, but this had little affect on the frequency.

Then I checked C411, R416 and R412 in the feedback network, even though these would have only a secondary affect on frequency. In fact, these all checked out OK. By now, I felt I had to accept that the multivibrator was probably running within tolerance, and I would have to look elsewhere.

So it was back to the sync pulse. But I was still working blind. Was the amplitude of the pulse at TP201 correct, or was it low? And similarly for the other pulse waveforms. If only I had a good set as a reference. And with that thought came inspiration. One of my customers did have such a set, and I had serviced it only a couple of months previously. With a little guile I could make use of it.

So I loaded the CRO into the van, drove to the customer's home and, on the pretext of giving the set a (free) routine check after service, I gained access to the chassis. (No doubt the customer was surprised that I was being so conscientious, but it didn't harm my image.)

The first thing I checked was the waveform at TP201, and this was exactly the same shape and amplitude as on the faulty set; no problem there. The same thing applied at the grid of the sync separator valve, but it was a different story at the junction of C402 and D400, even though the difference was somewhat subtle without being able to make a side-by-side comparison.

The truth is I couldn't be quite sure what the differences were right then. All I could do was take very careful note of the waveform, then hurry back to the workshop while it was still fresh in my mind. (What a way to make a living!)

DIFFERENT WAVEFORMS

When I looked at these waveforms there was no doubt in my mind; two differences were immediately obvious. One was the amplitude of the sync pulse, which was only about 10V p-p on the faulty set, as against 20V on the good set. The other was more subtle, but involved the outline of the frame pulse which could only be described as "mushy" in the faulty set, as against a clean outline on the good set.

I eventually established that this "mushiness" was really a pattern of line sync pulses which, somehow, were getting mixed up with the frame pulses. Just how much this was contributing to the fault I'm not sure, but it clearly indicated something wrong.

But I still had to find the cause. There seemed little doubt that it must be somewhere in the pentode sync separator stage, but I had already checked or replaced most of the components in this section, quite early in the exercise. These included R426 and R425, which had been replaced, and C415 (100pF) which had been checked on the bridge. It had checked out OK and been refitted.

But it had to be something. So there was nothing for it but to go over these components again, replacing them all if necessary, until the faulty one was found. It so happened that the first one I chose was C415, which I pulled out and replaced.

And suddenly everything was back to normal. The pulse amplitude jumped to 20V, the "mush" disappeared, and, most importantly, the picture stopped rolling. But why? I had already checked that capacitor and could find nothing wrong with it. What had I missed?

I put it on the bridge again and there was the answer. Whereas it had previously measured something like 105pF it was now down to 40pF. What was more, nothing I could do would change that valve. I heated it, cooled it, even bashed it, but it stuck stubbornly at 40pF.

In the days that followed, I checked that capacitor many times, and not once did it have the same value; 50pF, 100pF, 63pF, and so on. And, regardless of the value it elected to assume for the day, nothing could change it from that value. Why? You tell me and we'll both know.

As far as the set was concerned, I gave it a good workout over the next several days then, with my fingers crossed, took it back to the customer. That was several weeks ago, and my most recent check back, a few days ago, confirmed that it hasn't missed a beat.

Which is all very gratifying to the ego, but not much help in balancing the books. The second half of the exercise took up a lot of time, but there was no way I could charge for it. Even if the first component I replaced (C402) was genuinely faulty, as I suspect it was, it was playing only a minor part in the overall problem. So, in simple terms, the real fault had not been found when I took th set back the first time and charged the customer.

Which is all part of the service game. You have to take the rough with the smooth. When I'm tempted to gnash my teeth over a job like this I try to recall all the walk-in, walk-out, all-over-in-10 minutes jobs I've had, and which help to offset it.

To change the subject, here is a story from a New Zealand reader, Mr R. N. of Wellington. Mr R. N. makes some nice remarks about this column, and insists that it is always the first thing he reads in the magazine. Then he goes on to describe a strange fault he encountered in an old valve type radio. This is how he tells it.

OLD VALVE RECEIVER

This concerns a Philips BC/SW radio type 596, with a valve line-up of EF39, ECH35, ECB33, and push-pull EL33s in the output — a beautiful receiver capable of superlative performance when working properly. The set belonged to a neighbour, who had had it in storage for many years, and decided to resurrect it.

He found it to be working, except for a loud howl when tuned to a station at about 560kHz. Knowing my interest in old sets he asked whether I could fix it and, being intrigued, I agreed. I remarked that, considering its time in storage, and the likely effect on the electrolytics, he was lucky to get away with only a howl.

I soon determined that the howl was due to a spurious signal beating with the set's own local oscillator. The spurious signal was being generated somewhere within the set, but the question was, where? I thought of decoupling and earthing faults, but I also observed that literally everything I touched in the set, including the chassis, caused a slight shift in frequency.

I checked all the earths for dry joints and found none. I checked all the decoupling capacitors for open circuits and found none of these either. I then tried disconnecting the HT from various

TAKE THE LID OFF A VIC* AT . . .

OPEN SATURDAY

Video Interface Computer by commodore

INGREDIENTS: 5K Ram (Expandable to 32K), 16K ROM Operating System, Full Size Keyboard with four Function Keys, Colour Output which is easily programmed, ASCII and Full PET Graphics, three Sound Generators and a White Noise Generator (for Sound Effects), Expansion Port, Serial Port, Cassette Port, User Port, Game Port, Etc, Etc . . .
External Modulator is supplied to enable use with any Colour Television or Monitor. All this for $399.

A wide range of Accessories including Disk Drive, Printer, High Resolution Graphics, Expansion Module, 40 Column Converters, Program Tapes and Cartridges, etc are now available.

EDIBLE ELECTRONICS 50 PARK STREET, ABBOTSFORD, 3067.
PHONE: (03) 41 5708.

bankcard welcome here

parts of the set to see what stopped the oscillation, and found that removing the voltage from the output stage screens seemed to stop it.

This was somewhat inconclusive as, with the stage disabled, I needed an oscilloscope to confirm the cure. And, anyway, why should an output stage produce a 500kHz signal and still work correctly?

Little did I know!

I was beginning to despair by now, and was reduced to proding, poking, and knob twisting in the hope that I might stumble on a clue. Not very professional, I agree, but this time it paid off. I found that I could shift the oscillation frequency slightly with the audio tone control, a simple R/C network on the output stage.

Thus encouraged, I made a very careful check of all components in this section and, in the process, I moved one of the output valves in its socket. Lo and behold, the oscillation ceased, and I was unable to restore it. Closer inspection showed that the grid pin of the EL33 was corroded and that moving it had cleared the condition. For some reason, this had caused the valve to oscillate.

A COMMON PROBLEM

Thank you, R. N. for an interesting story. The truth is that these valves, and their ancestors, the EL3, were notorious for their tendency to spurious oscillation. Excellent performers though they were, their high gain made them very critical, and called for very careful circuit design.

Not that they were the only output valves that could oscillate. Many years ago the story was told about a serious interference problem experienced at Sydney Airport, not long after the first VHF aircraft-to-ground circuits were established after the war. The interference took the form of broadcast signals appearing on the channel for long periods and followed a fairly regular pattern.

Naturally the authorities were horrified, and lost no time in getting their DF equipment to work and tracking down the source. It turned out to be an ordinary pre-war vintage domestic radio set, close by the airport which used (I think) a type 42 valve in the output. It was oscillating, at the aeronautical frequency, the signal being modulated by the local broadcast program, as selected by the owner.

Even more intriguing was the reason for the frequency it had elected to generate. Investigation showed that the speaker cable was just one quarter wavelength long at that frequency, and had been acting as a tuned line to set the frequency and, no doubt, as a quite effective antenna into the bargain.

So take heart, R. N., you're not the only one who has been caught.

INTERESTED IN ELECTRONICS?
THEN WHY NOT TURN YOUR HOBBY INTO A CAREER?

Alan Mulraney, Stott's Graduate, in his workshop.

In this fast-changing electronic world people with interest and training are going to be in demand. Turn your interest into a lucrative career in any one of the following fields:

Computers • Industrial Controls • Medicine
Radio Communications • Domestic Radio & Television

Electronics plays an important role in these and many other fields. With a Stott's Home Study Course, training is easy, and will prepare you for a career in the manufacture, installation, commissioning, sales or servicing of electronic equipment.

You'll have experienced, professional instructors who will guide you through an integrated theory/practical program. They'll give you individual attention and advice, and prompt replies to all test assignments and queries. And best of all, you'll study at your own pace, in your own home.

Send the coupon today. It may be the smartest move of your life.

Stotts
TECHNICAL CORRESPONDENCE COLLEGE
The name to trust in correspondence education.

Melbourne, 159 Flinders Lane, 3000. Tel: 63 6212
Sydney, 383 George Street, 2000. Tel: 29 2445
Brisbane, Suite 3, 65 Mary Street, 4000. Tel: 221 3972
Adelaide, 85 Pirie Street, 5000. Tel: 223 3700
W. Perth, 25 Richardson Street, 6005. Tel: 322 5481
Hobart, 1st Fl. 29 Argyle Street, 7000. Tel: 34 2399

Please send me free, and without obligation, full details of the following courses:

________________ (PLEASE PRINT)
____
MR. MRS. MISS ________________ AGE ____
ADDRESS ________________
________________ POSTCODE ______
Stott's undertake that no sales counsellor will visit you.

The Stott's range of courses in Electronics is:

Intro to Electronics
Digital Electronics for Technicians/Servicemen
Microprocessors
AM Radio Receivers
Radio/TV Servicing
Colour Television

ALA/ST3596/EA882

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

$ TAX TIME SELLOUT — $
'OUCH!'

YES! It's that dreaded tax time again and as we're compelled to grace the Treasury Coffers with just about all our ready cash (and some of the banks!) we are liquidating all of these quality products at cost or even below cost — YOU REAP THE BENEFIT!

SALE CONTINUED FOR AUGUST

VELOSTAT

Non-static sheeting for storing CMOS IC's, LSI's etc. 1000 times better than aluminium foil. Will store up to 150 IC's on one 225 x 150mm sheet.

H 0500 . . . . ~~$3.50~~ per sheet

NOW $2.00 a sheet — GAD!

WEATHERPROOF SIREN HORN

12V DC operated — Deafening Siren Wail. Super handy for audio signalling, secruity systems etc. Current drain 500MA approx. Completely weatherproof. Attractive off-white PVC finish.

S 5058 . . . ~~$19.50~~ **NOW $15.00 ea. STREWTH!**

MINI BUZZER 5-15V DC

Handy little solid-state audio "Buzzer" or signalling device. Just the shot for communicator panels, or for timer alarms or in the car. Polarity conscious.

S 5062 . . . ~~$1.95~~

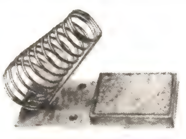
NOW $1.00 each

PIEZO ALARM

Similar to "Sonalert" type. Absolutely ear piercing sound. Recommended voltage 5-15V DC. Ideal for almost all audio signalling applications. i.e. fire, water and gas signalling, computer alarms, etc.

S 5066 . . . ~~$4.95~~ **NOW $3.00 each HEY!**

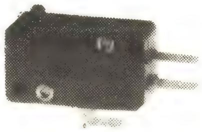
SOLDERING IRON STAND UNIVERSAL TYPE



T 1302 . . . ~~$5.95~~ **NOW $4.00 GOSH!**

MICRO SWITCH

125V 3A AC (250V 1.5A)
Single pole change over contacts.



S 3250 . . . **$1.50**
10 Up . . . **$1.20**

MIC INSERT ELECTRET

Great little replacement for tape recorders, etc. Handy for hobby projects. Includes data sheet and application circuit. 50 HZ - 15 KHZ

C 0170 . . . ~~$1.95~~ **NOW $1.00—OUCH!**

Incredible!

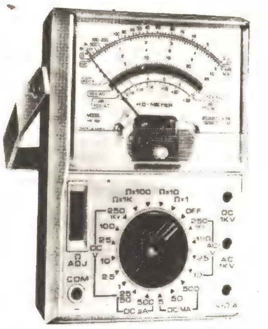
UNIVERSAL MULTIMETER

PORTABLE WITH BENCH STAND

23 ranges at less than $1 per range.

★ 20,000 OHMS/Volt DC ★ 10,000 OHMS/Volt AC ★ Mirror backed scale ★ Overload protected ★ Unique carry handle doubles as a bench stand ★ High-impact resistant case ★ Uses 1 AA Penlight batter (incl.) ★ Comes complete with battery, test leads and instructions. **RANGES: DC Voltage** 0-.25, 1, 2.5, 10, 25, 100, 250, 1000. **AC Voltage** 0-10, 25, 100, 250, 1000 **Decibles** 20 to +22db **DC Current** 0-50, 500 UA, 0-5, 50, 500MA **OHM Meter** 0-6 megohms in 4 ranges, 30 ohms centre scale. Size 135 x 91 x 39

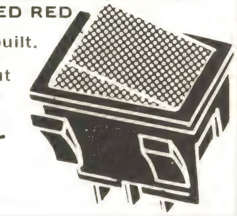
Q 1002 . . **$22.50** 4 or more . . **$21.00**



A FREE Carry Case Cat. Q 1012 $3.50 value with every meter purchased from this advert — YES! that's right — yours for the asking.

MC MURDO ROCKER SWITCH

DPDT ILLUMINATED RED



250V Neon lamp inbuilt. Contact rating 250V AC 15A. Panel cutout 27 x 22mm. Positive "snap in" mounting.

S 3240 . . ~~$2.50~~

NOW $1.25 each

LAVALIER (LAPEL)

Superb little microphone. Clips to tie, shirt etc. Ideal for lecturers, religious speakers, stage work etc. Uses 1.5V alkaline manganese LR44 batter (supplied). Includes tie clip.

C 0353 . . ~~$29.95~~

NOW $20.00 each

MINI SPEAKER 57mm

200MW 8 OHM

Large Ferrite Magnet. Ideal replacement speaker. Great for hobby projects.

C 0610 . . ~~$1.90~~

NOW $1.00

FUSE HOLDER 3AG

32 x 6.3mm Fuse

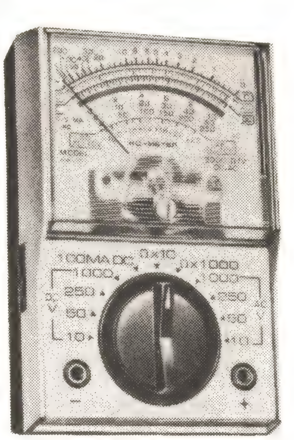
S 6000 . . . ~~.95~~

NOW .60c

MULTIMETERS

ECONOMY TESTER OVERLOAD PROTECTED

High 2000 OHMS/Volt sensitivity overload protected. Dimensions 90 x 60 x 30.



Mirror back scale prevents Parallax error. Complete with test leads and instructions. Uses 1 AA Penlight batt. (incl.). **Ranges:** DC and AC 0-10, 50, 250, 1000V **Decibals:** 10 to +22db. DCA 0-100MA. OHMS 0-1 meg. OHM in 2 ranges.

Q 1001
$12.50
4 or more
$10.00

CARRY CASES

"LEATHER LOOK PVC"

Q 1011 for Q 1001 meter	$2.50
Q 1012 for Q 1002 meter	$3.50

Dear Customer — Yes all these products are all first quality — and what's more, we're up to the rafters with stock.

PERSONAL SHOPPERS ONLY

With every store purchase of $30.00 or more ask for a FREE $5.00 purchase voucher. This voucher can then be used with any subsequent purchase from ALTRONICS — NOT VALID UNTIL DAY AFTER ISSUE DATE. Sorry not available to mail order customers.

INCREDIBLE OFFER ON EA's and ETI's JUST $1.00 EACH TO PERSONAL STORE CUSTOMERS!

That's right — EA and ETI Magazines are just $1.00 each to our valued Electronic Enthusiast store customers. We want more Electronic Enthusiastis to buy these great magazines and build the fascinating projects described each month — So as an ALTRONICS customer service to you **WE ARE SELLING THEM FOR AROUND HALF PRICE — JUST $1.00 EACH**

Limit: 1 of each mag. per customer. Sorry, this offer is not available to Mail Order Customers.

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

PRICES SLASHED

with Premium Grade Quality Imports from Altronics

Why Pay More?

Powerful New 6000 RPM Mini Drill for PC Work

Tons of Torque. Just the shot for PCB work. 12V DC operated from external Power Pack 1.2mm chuck capacity. Supplied c/w 1mm drill bit.

T2302	**$12.95**
Drill Bits:	
T2320 (0.8mm)	**$1.25**
T2325 (1.2mm)	**$1.25**

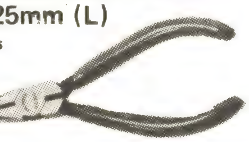
Micro Tools

Highly recommended for fine precision work. Finest carbon steel. Insulated handles.

MICRO CUTTERS 100mm (L)

T 2070 . . . **$7.50**

MICRO LONG NOSE PLIER 125mm (L)



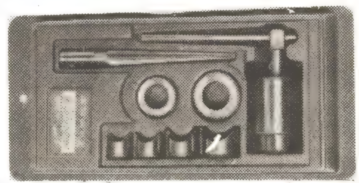
Will handle work as fine as a human hair. Diagonal cutting edge.

T 2075 . . . . **$7.25**

HOLE PUNCH SET

A must for every enthusiast or serviceman. Cuts holes in metal up to 1.6mm (16 gauge). Set of 5 punches and tapered reamer.

Punch sizes:
16mm
18mm
20mm
25mm
30mm

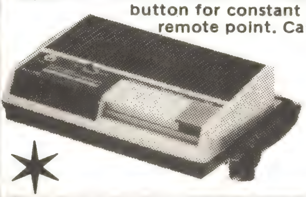


T 2360 . . . . **$15.00**

FM WIRELESS INTERCOM

2 CHANNEL TYPE

No batteries or wiring needed. Simply plugs into 240V mains socket and presto your in business. A and B channel allows selection to separate remote stations. Includes talk lock button for constant monitoring of remote point. Call tone facility.



A 0450
$55.00
PAIR
Why Pay
$69

Incredible Value Dainichi Loudspeakers

DAINICHI WIDE RANGE 25 Watt

200 mm (8 in.). This superbly smooth high power speaker comes from **Dainichi**, one of Japan's finest speaker manufacturers **(they produce OEM Speakers for Pioneer)**. Max. input power 25W 8 OHM Z. Resonant fo 60 HZ. Huge 10 OZ Magnet frequency response 40 HZ-18 KHZ.

C 2001	**$19.50**
4 or more	**$17.00**

DUAL CONE WIDE RANGE

200 mm (8 in.). 10 Watts Max. power input. Public Address, Background Music. Ideal Hi Fi extension speaker. Includes transformer holes at 51 mm.

Over 30,000 sold in Australia!

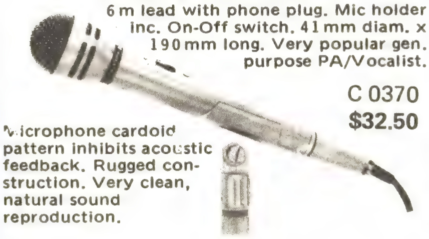
Mounting holes 140 x 140 mm

C 2000	**$8.50**
10 Up	**$7.90**

Outstanding Value Microphone

DYNAMIC UNI DIRECTIONAL

50K and 600 OHMS. 60 HZ - 15 KHZ 6m lead with phone plug. Mic holder inc. On-Off switch. 41mm diam. x 190mm long. Very popular gen. purpose PA/Vocalist.



C 0370
$32.50

Microphone cardoid pattern inhibits acoustic feedback. Rugged construction. Very clean, natural sound reproduction.

At last the C0380

Absolutely Superb. Less than ½ the price of Comparable Microphones.

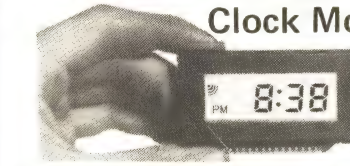
STUDIO/STAGE CARDOID MICROPHONE

30 HZ - 16 KHZ
Low Z balanced output

Heavy zinc die cast housing, complete with quality padded carry cases. Low acoustic feedback incidence

C 0380 . . . . . . **$49.50**

New 10mm Digit LCD Clock Module



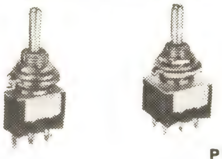
Uses the new NEC UPD833G LSI and quality EPSON LCD display.
Size 60 x 38 x 10mm, operates from 1.5V DC.
Display selectable to 12 or 24 hour format. AM/PM Display.
Inbuilt control timer selectable to 15, 30, 60 and 120 minute intervals.
Stop watch facility to 24 mins duration. Alarm timer, Snooze timer, Sleep timer.
An incredible diversity of applications.
i.e. clock radio, travellers watch, stop watch, digital alarm clock, sleep timer, snooze timer, appliance timer, sequential controller, dual time clock.

And the best news is the low price!

Y 1020 . . . . **$16.50**

MINI TOGGLE SWITCHES

OEM QUALITY 250V 2 AMP RATED



		PRICE	10 UP
S 1010	SPDT	**$1.20**	**$1.00**
S 1025	SPDT Centre off	**1.40**	**1.20**
S 1020	DPDT	**1.40**	**1.20**
S 1030	DPDT Centre off	**1.95**	**1.75**

DIL Switch Bargains

GOLD PLATE SELF WIPING CONTACTS

		ea.	10 up
S 3050	4 way	$1.25	$1.10
S 3060	8 way	$1.75	$1.50

DIODES RECTIFIER

				ea	10 up
Z 0105	IN4002	100V	1A	.06	.05
Z 0109	IN4004	400V	1A	.08	.06
Z 0112	IN4007	1000V	1A	.12	.10
Z 0115	IN5404	400V	3A	..35	.28
Z 0118	IN5408	1000V	3A	.40	.34
Z 0120	R250A	400V	6A	.80	.70

DIODE BRIDGES

Z 0130	WO2	200V	1.5A	.60	.55
Z 0132	WO4	400V	1.5A	.65	.58
Z 0134	PW005	400V	6A	2.00	1.80
Z 0138	MDA2504	400V	25A	4.50	4.00
Z 0139	MDA3504	400V	35A	4.95	4.50

ALTRONICS

For Address, Phone No. and Despatch details see our Double Page Advertisement pages 16/17.

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

Measure distances electronically

Ultrasonic rule with digital readout

Here is a device which uses a rather novel way of measuring the distance between two objects. Scorning the more conventional methods of tapes and rules, it uses a system akin to the sonar devices used to detect submarines, though on a much smaller scale.

by COLIN DAWSON

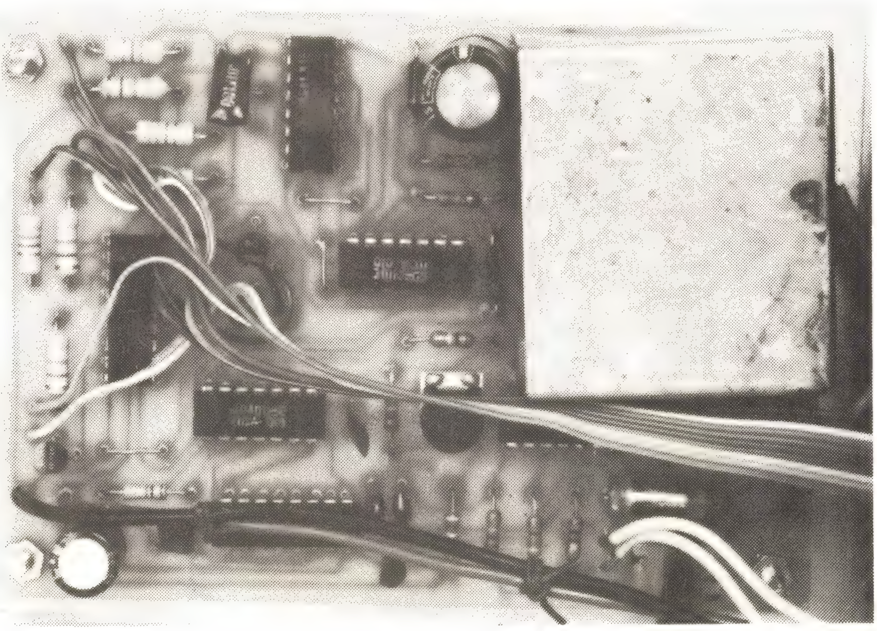
The need for such a device may not be immediately obvious, and the reader may well ask, "What's wrong with a tape measure, anyway?" To which we might reply, perhaps somewhat facetiously that a tape measure is not nearly as scientific!

But, seriously, there are situations where conventional methods present difficulties, particularly when the distant object is out of reach. Examples include high ceilings, or walls to which one may not have direct access for any number of reasons (including the fact they they may be on private property).

We understand that similar commercial devices are used by carpet salesmen to make a quick and reasonably accurate measurement of a room, on which to base a quote, without the need to move furniture or employ an assistant to hold the other end of the tape.

Whether our device is good enough for this latter application may be debatable, much depending on the experience of the person using it. But if any of these situations strike a chord, or suggest other problems which our device might solve, then read on.

The principle behind the device is quite simple. An ultrasonic transducer (40kHz) is pulsed by an oscillator and projects a burst of ultrasonic energy towards the object to be measured. Some of this energy is reflected and returns to the unit where it is intercepted by a second (receiving) ultrasonic transducer. The time taken for the outward/inward journey is a measure of the distance, and is converted into centimetres for direct reading.



View showing the main PCB assembly. The metal shield is held by two self-tapping screws, one which earths the shield to the earth track on PCB.

Circuit details

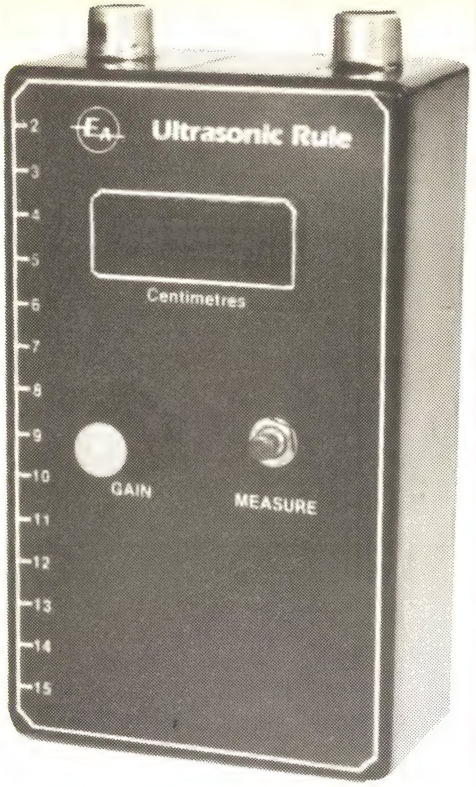
For a more detailed explanation, let us look at the circuit. The transmitter consists of IC1, a BC558 transistor (Q1), a 1kΩ:8Ω speaker transformer, and the ultrasonic transducer. NAND gates IC1b and IC1c form a 40kHz oscillator which runs continuously, while IC1a functions as a control gate between the oscillator and the output transistor (Q1).

The exact frequency of the oscillator can be adjusted to suit the resonance of the transducer by means of trimpot VR1, while the signal level fed to the transducer is controlled by trimpot VR2 in the collector circuit of Q1.

The receiver consists of a second ultrasonic transducer, a four-stage transistor amplifier (Q2-Q5), pulse shaper IC3b, and gating stage the IC3a. Total gain is around 33,000 times at 40kHz, most of this coming from the four transistors.

So much for the basic sections of the device. We now have to put them to work and measure the results they produce. First we have to pass a 40kHz pulse to the transmitter output circuit and, at the same time, turn off the output from the receiver for at least this period, or longer, in order not to confuse the counting circuits.

To perform these functions we start with a 10Hz oscillator consisting of NAND gates IC2a and IC2b, the output of which goes to pin 14 of IC5, a 4017 decade counter, which delivers 1Hz



The prototype can measure distances ranging from 50cm to about 7 metres.

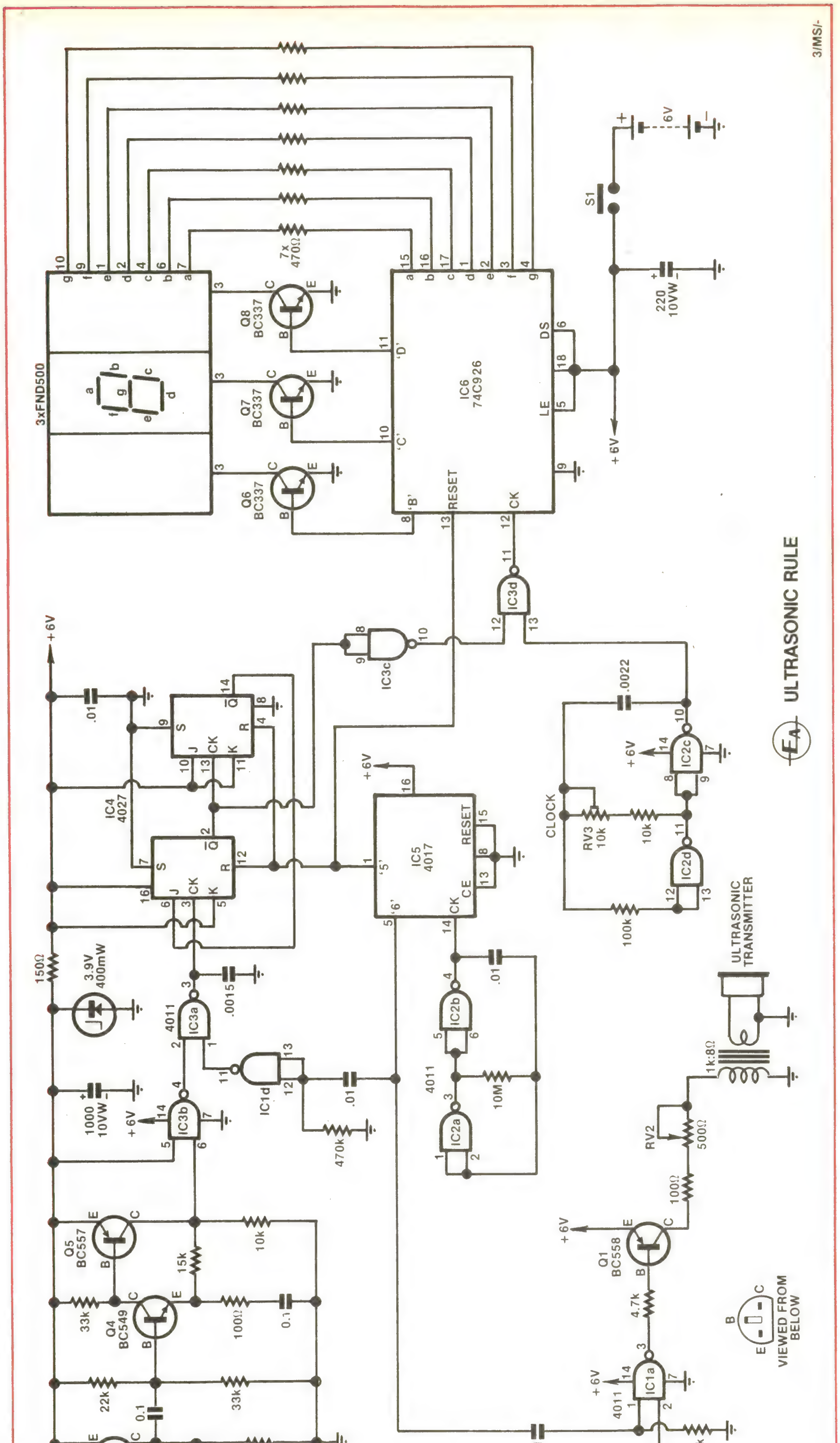
pulses of 100ms duration at pins 1 and 5. The pulses from pin 5 are coupled to pin 1 of IC1a via a .01μF capacitor. This capacitor, in conjunction with the associated 27kΩ resistor, reduces the pulse length to approximately 0.15ms, and the transmitter is gated on for this period.

At the same time, the 100ms pulses from IC5 are fed to IC1d via a .01μF capacitor which, in association with a 470kΩ resistor, gives a time constant of about 3ms, 20 times that of the transmitter "on" period. This pulse is inverted by IC1d and the output taken to pin 1 of IC3a, which gates off the receiver output during this period.

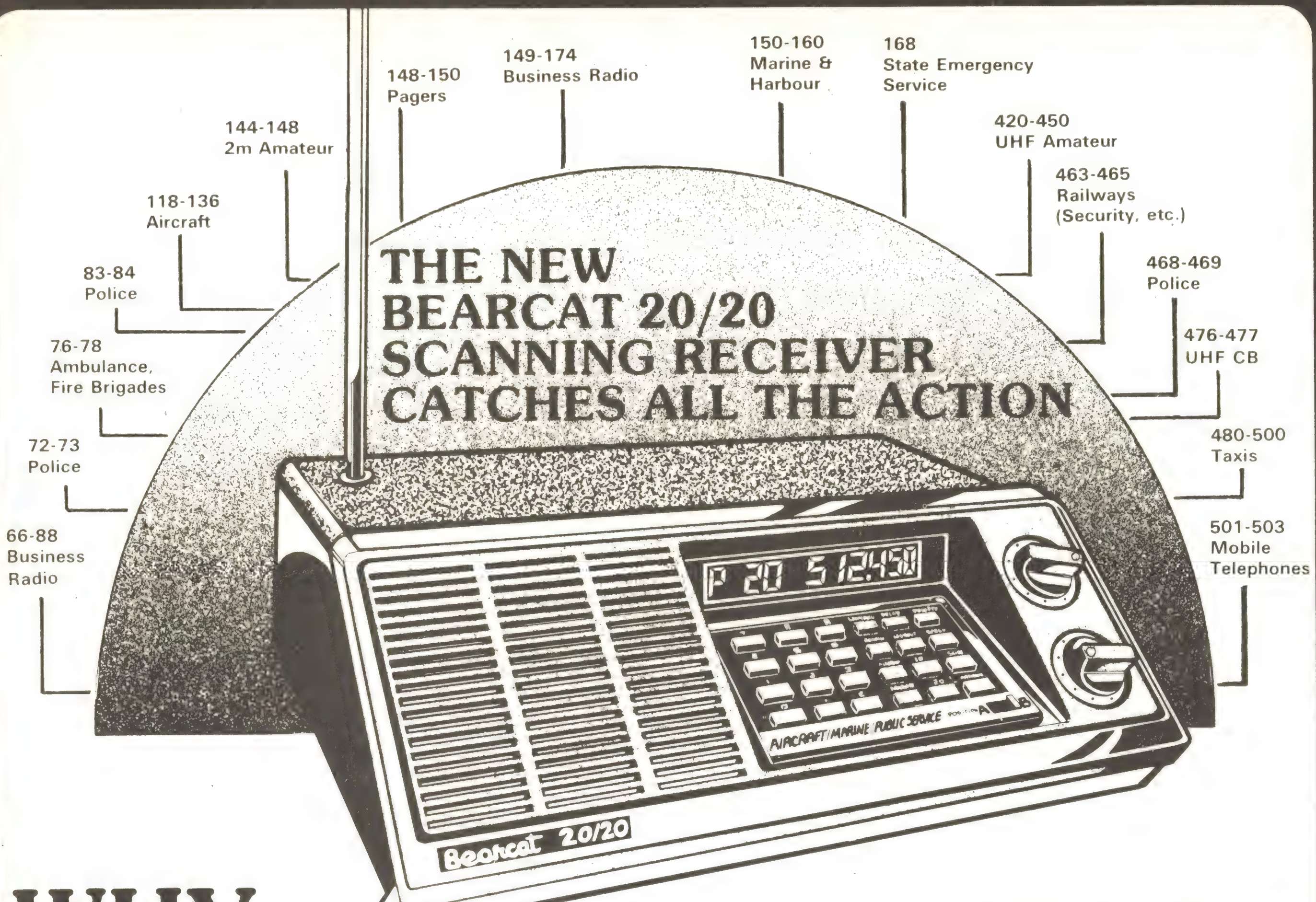
The purpose is to inhibit the receiver output during the transmit time, and for a significant time afterwards. The extended time is necessary to allow for any ringing in the transmitter transducer which, because of its high Q, can be quite lengthy. While ever this is strong enough to pass through the receiver and affect the counting circuit, it can cause a false reading.

As a result of this inhibit time, there is a minimum distance below which the device will not function. Based on the above figures this is about 50cm, which is an acceptable compromise.

At the end of the 3ms inhibit period, IC3 is gated on and any pulse sensed by the receiver is passed to pin 3 of IC4, a



ULTRASONIC RULE



THE NEW BEARCAT 20/20 SCANNING RECEIVER CATCHES ALL THE ACTION

WHY PAY MORE?

Introducing - a brand new communications hobby - the latest craze in the U.S.A. and now sweeping Australia.

It's called 'Scanning' - and you can catch **ALL** the action with the latest in microprocessor controlled scanning receivers - **The Bearcat 20/20** - exclusive to Dick Smith Electronics.

This incredible receiver covers most of the VHF and UHF bands - where all the exciting action is these days.

Want to listen in to a few specific stations (up to 40!)? Simply punch a few buttons and let the **Bearcat's** computer search through them for you.

If you don't know where they are, no problems: **The Bearcat 20/20** will search for them for you.

The Rolls-Royce of scanners can now be yours - catch up on all the action with **The Bearcat 20/20** scanner, only from Dick Smith Electronics.

NOTE: Owning and operating a scanning receiver is now completely legal. You're allowed to listen in to any station you desire

When you buy from Dick Smith you cut out the middle man — importers, wholesalers and distributors — who add their margin and inflate the price you pay. Dick imports direct from the manufacturer to you and passes on the savings.

SPECIFICATIONS:

Frequency range: 66-88MHz, 118-136MHz, 144-174MHz, 421-512MHz

Power Source: 240V AC or 12V DC

Antenna: Inbuilt whip, provision for external beam

Sensitivity: Most bands 0.4uV

Selectivity: -55dB @ ± 25kHz

Scanning speed: Selectable, 5 or 15 channels/second

No. of programmable channels: 40

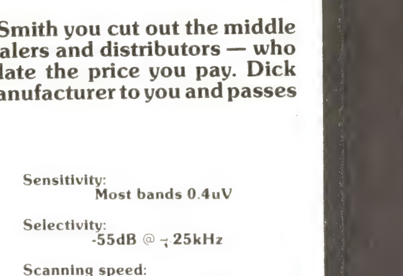
ONLY

$475.00

Cat D-2810

ALSO AVAILABLE:

Economy BEARCAT 150FB

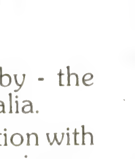


With up to 10 Channels, base station operation only. Similar range to above (up to 490MHz), touch-pad controls.

Cat D-2800

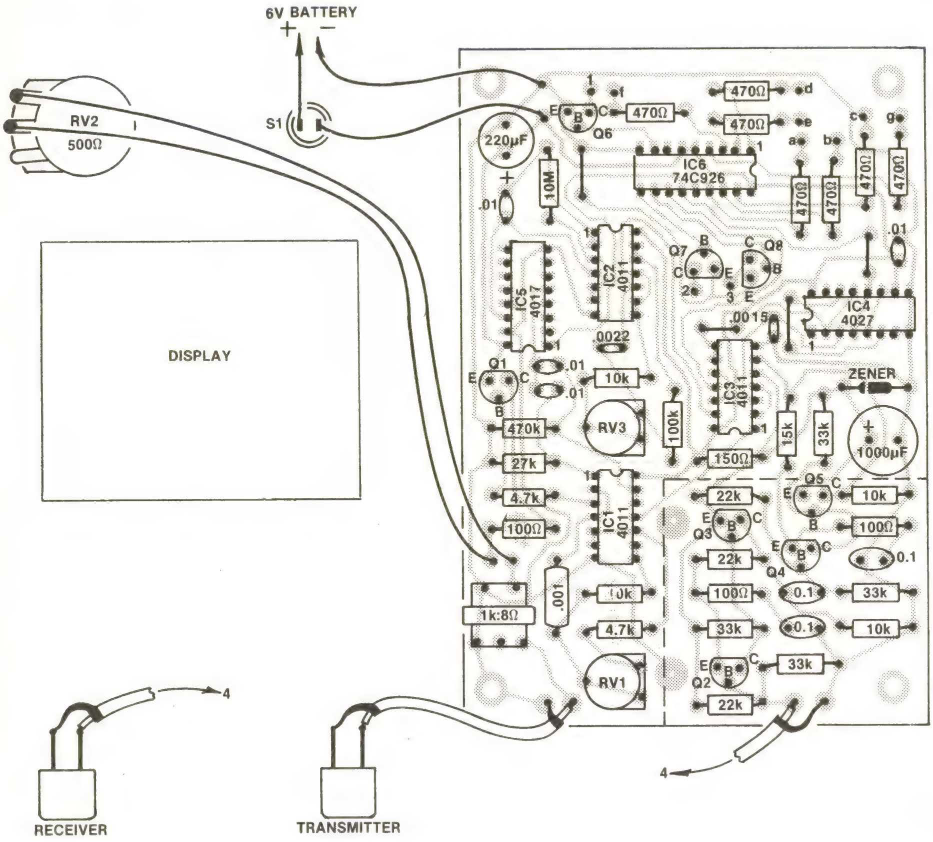
Incredibly low price - only $275.00

EXCLUSIVE TO DICK SMITH ELECTRONICS



4309/FI

SEE PAGE 124 FOR STORE ADDRESS DETAILS.



Wiring diagram and parts layout of the main PCB. The area inside the dotted line should be covered by a metal shield fashioned from tinplate (see diagram).

PARTS LIST

1 1kΩ:8Ω miniature audio transformer
1 40kHz ultrasonic transmitter
1 40kHz ultrasonic receiver
1 printed circuit board, code 82ur8, 84 × 125mm
1 printed circuit board, code 80st10b, 57 × 48mm
1 SPST momentary contact switch
1 knob to suit
1 Scotchcal front panel, 88 × 151mm
1 4-cell "AA" battery holder (square)

SEMICONDUCTORS
3 4011 quad NAND gates
1 4027 dual J-K flipflop
1 4017 decade counter
1 74C926 4-digit counter
1 BC558 PNP transistor
2 BC557 PNP transistors
2 BC549 NPN transistors
3 BC337 NPN transistors
1 3.9V 400mW zener diode
3 FND500 7-segment displays

CAPACITORS
1 1000μF 10VW electrolytic
1 220μF 10VW electrolytic
3 0.1μF metallised polyester (greencap)
4 .01μF greencap
1 .0022μF greencap
1 .0015μF greencap
1 .001μF polystyrene or greencap

RESISTORS (¼W, 5%)
1 × 10MΩ, 1 × 470kΩ, 1 × 100kΩ, 4 × 33kΩ, 1 × 27kΩ, 3 × 22kΩ, 1 × 15kΩ, 4 × 10kΩ, 2 × 4.7kΩ, 7 × 470Ω, 1 × 150Ω, 3 × 100Ω, 2 × 10kΩ 5mm horizontal trimpots, 1 × 500Ω linear potentiometer

MISCELLANEOUS
Shielded cable, hook-up wire, rainbow cable, machine screws and nuts, epoxy adhesive, scrap aluminium for battery clamp, tinplate (93 × 91mm) for shield, 4 "AA" 1.5V batteries.

4027 dual J-K flipflop. But before such a pulse is received a lot of other things happen and, to understand these, we must put aside the receiver function for the moment.

Let us look now at IC2 and IC2d. This is a clock oscillator running at 166kHz, being set to this frequency by trimpot VR3. It is these pulses which are counted between the time a pulse is transmitted and the time a return pulse is sensed by the receiver. They go via IC3d, functioning as a gate, to the clock input (pin 12) of IC6, a 74C926 counter.

The figure of 166kHz has been selected on the basis that, at the speed of sound in air, each pulse counted represents 1cm. (For inches this would need to be reduced by a factor of 2.54 — to 65.4kHz approximately — by changing the .0022μF capacitor to a larger value.)

The manner in which IC3d is gated on and off, at the start and finish of the counting period, is quite a tricky arrangement. We have already learned that 1Hz pulses, derived from the 10Hz oscillator IC2a,b and by 10/1 division in IC5, are delivered at pins 1 and 5 of the 4017. More precisely, pin 1 of IC5 delivers the first pulse, and pin 5 delivers a second pulse 100ms later.

The pulse from pin 1 performs two functions: it resets the 74C926 counter to "000" via the counter's reset pin (13), and it resets both flipflops in the 4027. This latter action sets $\overline{Q}2$ (pin 2) high and, via the inverting action of IC3c, pulls pin 12 of IC3d low and gates off the 166kHz signal from IC2d to the clock input of IC6.

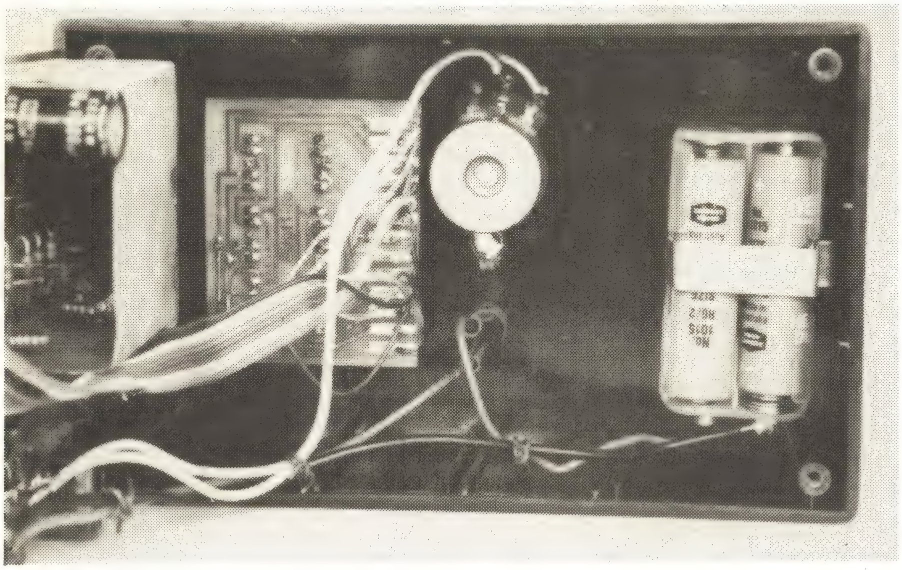
This sets the stage for the measurement sequence. The second pulse now appears at pin 5 of the 4017, gates on the transmitter and inhibits the receiver in the manner already described. But the receiver inhibit function goes one stage further; in gating off the receiver signals by means of IC3a it also sends the output (pin 3) of IC3a high which, in turn, takes CK2 of the 4027 high and pulls $\overline{Q}2$ low.

With $\overline{Q}2$ low, the pin 10 output of IC3c goes high, gates on IC3d, and allows the 166kHz clock pulses to reach the counter, which commences counting. This counting commences at the instant that the transmitter pulse commences. The output of IC3a subsequently goes low at the end of the receiver inhibit period, but the 4027 ignores low pulses at its clock terminals.

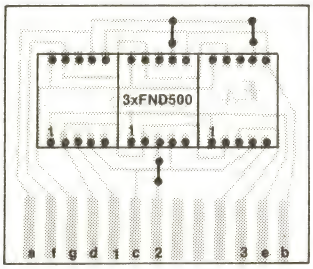
Counting continues until a return pulse is sensed by the receiver. Then the output of IC3a goes high again, the flipflop toggles, Q2 goes high, and counting ceases.

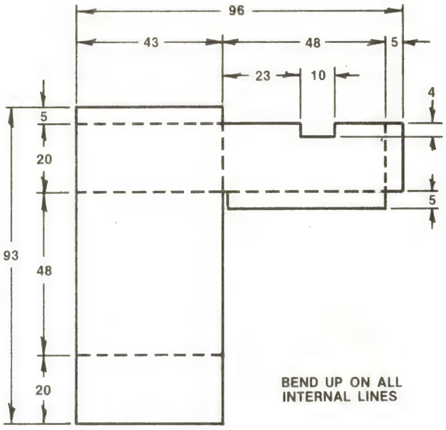
At this point the counting sequence proper is complete, but there is one more function. This is a protective function against any spurious return pulses, from more distant objects, which could upset the original count.

To understand this we must go back to the original reset action initiated by the pulse from pin 1 of the 4017. This sets both $\overline{Q}2$ and $\overline{Q}1$ high, $\overline{Q}2$ being subsequently pulled low by the inhibit pulse fed to IC3a. Although this pulse also appears on CK1 (pin 13), it is ignored because it is a low pulse to which these clock inputs do not respond.



Use rainbow cable to make the necessary connections to the display PCB. The batteries are held in position using a clamp fashioned from scrap aluminium.





Above: make sure that you mount the FND500s with the ribbed edge towards the top. At right is the metalwork diagram for metal shield.

As a result, $\overline{Q}1$ remains high until $\overline{Q}2$ goes high at the end of the count. This takes CK1 high, which sends $\overline{Q}1$ low, and J2 low with it. With J2 low, any further signals into CK2 will be ignored, this condition prevailing until the next reset sequence from the 4017.

The 74C926 is a four digit counter which drives a multiplexed seven-segment display. Only three digits – B, C and D – are used. As configured in this circuit, the 74C926 has its latch enable tied high so that it simultaneously counts and displays the number of clock pulses received. This counting operation is not really visible because of the speed of the count, and the very brief period involved. Only when the counting stops is the presentation readable.

As has probably been deduced from all the foregoing, the system transmits a pulse and makes a count once every second, and this is the rate of display update. There is nothing critical about this rate and the 10Hz oscillator from which it is derived uses fixed value components with no adjustment facility.

A point already mentioned briefly concerns energy from the transmitter reaching the receiver system by paths other than the wanted reflection.

One such path is the acoustic one already discussed in some detail, and this includes the mechanical path for acoustic energy provided by the case on which both transducers are mounted.

While the receiver inhibit period has been included to minimise this, transmitter transducer ringing can still be a problem. This is the reason for the variable resistor (VR2) in the transmitter output circuit; to reduce the strength of the transmitted pulse to no more than necessary in any particular situation. The need to control output is particularly important when new batteries have been fitted.

Another 40kHz leakage path is by direct electrostatic coupling, remembering that the 40kHz oscillator is running continuously. To control this field it was necessary to fit a metal shield over the receiver section.

Construction

Construction is straightforward, with most of the parts mounted on a main printed circuit board (PCB) coded 82ur8 and measuring 84 × 125mm. A separate display PCB, code 80st10b (57 × 48mm), carries the three FND500 displays, this board having originally been used in the Stylus Timer of October, 1980.

Assemble both boards according to the parts overlay diagrams, taking care to ensure correct polarity of all polarised components (transistors, ICs, displays, electrolytic capacitors, zener diode). Don't forget the four wire links on top of the main PCB, and observe the usual precautions when soldering in the ICs, which are all CMOS devices. These precautions involve earthing the barrel of your soldering iron to the earth track on the PCB, and soldering the supply pins first.

The supply pins are pins 7 and 14 for the 4011s, pins 8 and 16 for the 4027 and 4017, and pins 9 and 18 for the 74C926.

Details of the metal shield to be fitted over the receiver circuitry are given in the accompanying diagram. The shield is fabricated from tinplate and secured to the PCB by two self-tapping screws inserted from the copper side of the board. Check that the shield is connected to earth track of the PCB when the screws have been tightened down. You should also make sure that the screw heads are of lesser diameter than the locating pads on the board, to avoid any risk of shorts to adjacent tracks.

The complete unit is housed in a plastic zippy box measuring 50 × 94 × 158mm, with the main board mounted on the aluminium base. Carefully affix the Scotchcal adhesive label to the top of the box, then make the rectangular cutout for the LED displays by drilling and filing to shape. Finished Scotchcal labels will be available from kit suppliers.

Note that the Ultrasonic Rule measures the distance from the transducer elements to the reflecting surface. For this reason, the front panel artwork includes a handy scale down one side. When making wall-to-wall measurements, simply add the length of the box to the reading on the display.

The two transducers are mounted on one end of the box. Each requires two small holes for the terminal pins and is mounted flush against the case and held in place with a small ring of epoxy

RADIO — FOR LIFE

THE BRILLIANT MARC NR 82 FI

BUY THIS SPECTACULAR PERFORMANCE 12 BAND RECEIVER AND YOU WILL NEVER NEED ANOTHER. NEVER BEFORE HAS SUCH AN AMAZING RADIO BEEN OFFERED FOR THE PRICE.

FEATURING: Digital frequency Display, SSB/CW, FM/AM reception, B.F.O., Double Conversion, Double Super-het, crystal controlled (VHF) Local Oscillator, 4 inbuilt antennas and good looks, you will spend hours just learning how to drive it!

SEE REVIEW PAGES 22, 23 THIS ISSUE

$10 Pack and Postage anywhere in Australia

only $349

3 Way Power

★

Digital Tuning

★

HI FI SOUND

★

4 Inbuilt Antennae

STRICTLY LIMITED STOCKS

SPECIFICATIONS:

Semi-conductors: 1 - LSI, 4 - IC's, 7 - FET, 34 - Transistors, 1 - Voltage regulator and 42 - Diodes

Frequency range:

LW	145-360	KHz	VHF1	30-50	MHz
MW	525-1600	KHz	VHF2	68-86	MHz
SW1	1.6-3.8	MHz	VHF3	88-108	MHz
SW2	3.8-9	MHz	VHF4	108-136	MHz
SW3	9-22	MHz	VHF5	144-176	MHz
SW4	22-30	MHz	UHF	430-470	MHz

Output power: 5.0W (Max.)

Power supply: AC 240V 50Hz. DC 12V (8 x "D" cells). Ext. DC 12V Car/Boat.

Speaker: 12.5cm Permanent Dynamic Speaker (3.2 ohm)

Antenna: Ferrite Bar Antenna for LW, MW and SW1
3 x Telescopic Antenna for SW, VHF and UHF

Controls: Power ON-OFF switch — Digital display ON-OFF switch — Tape-Radio switch, Wide-Narrow band selector switch, AM band selector (LW/MW/SW1/SW2/SW3/SW4), VHF band selector (VHF1/VHF2/VHF3/VHF4/VHF5/UHF), Ant. Selector (Telescopic ANT./EXT. ANT.), Tuning control (direct gear drive), volume control, Bass control, Treble control, Squelch control, BFO pitch control, RF gain control, Antenna adjustor control, Mode switch (USB-NOR-LSB/CW)

Terminals: Ext. Speaker/Headphone Jack, Tape IN-OUT jack, VHF/UHF ANT. connector (coaxial), SW EXT. ANT. terminal (Screw), Ext. battery jack

Meter: Tuning Meter

Digital Frequency Counter Section:

Display: LW/MW/SW-1 KHz
SW2-4/VHF1-5 MHz

Control: SW Calibrator

Dimensions: 452mm (W) x 288mm (H) x 130mm (D)

Quantities strictly limited: Grab one now for only $349. 7 Day money-back guarantee

Order with your Bankcard — simply include your B/Card Number and expiry date together with your full name, address and telephone number. Allow approx. 7 days for delivery

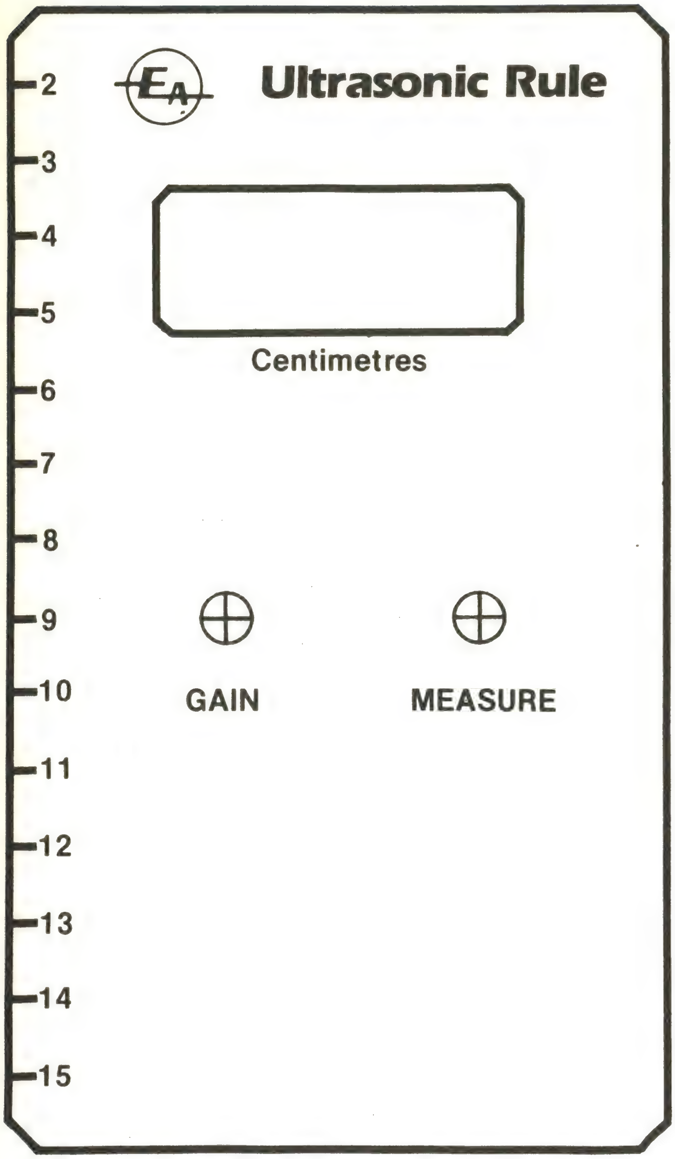
Available from either of the following stores

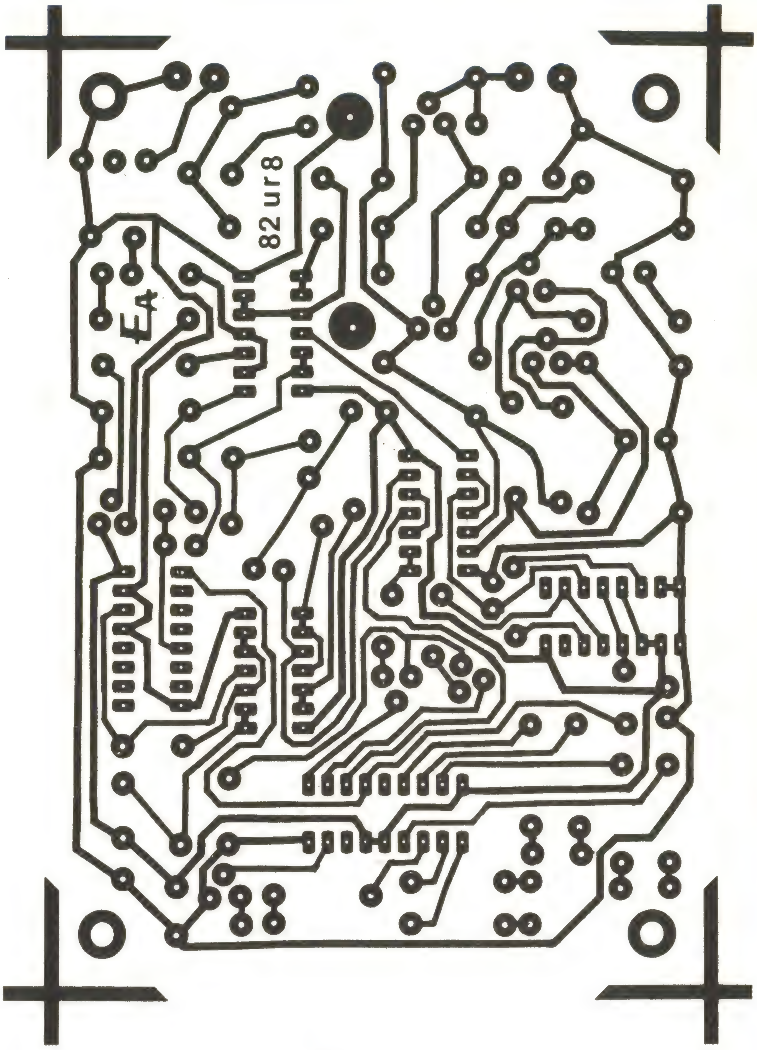
ALTRONICS
105 Stirling Street,
Perth, W.A. 6000
Phone (09) 328 1599
Mail Order Address:
C/- P.O. Box 8280,
Perth, Stirling St., WA 6000

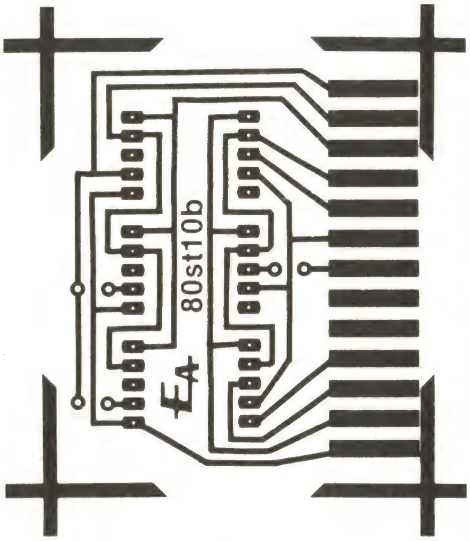
JAYCAR
125 York Street,
Sydney, NSW 2000
Phone (02) 264 6688
Mail Order Address:
C/- P.O. Box K39,
Haymarket, NSW 2000

SEVEN DAY SATISFACTION GUARANTEE

AND OF COURSE 90 DAY 100% PARTS AND LABOUR WARRANTY







All artworks are shown actual size.

adhesive. The transmit and receive devices are not identical, so make sure they are properly identified.

The unit is powered by a 6V battery pack consisting of four "AA" size batteries in a plastic holder. Current drain is in the order of 30-35mA and is quite reasonable for cells of this size, particularly in view of the short duty cycle. We used a bracket fashioned from a piece of scrap aluminium to secure the batteries in position.

Adjustments

Once the unit is working, there are two adjustments to make. One is to trim the 40kHz oscillator (IC1b, IC1c) by means of VR1 until it agrees with the natural resonance of the transmitter transducer. The other is to calibrate the unit by adjusting the clock oscillator (IC2c, IC2d) by means of VR3.

To peak the 40kHz oscillator we first need a means to measure the strength of signals reaching the receiver. A suitable method involves connected an AC millivoltmeter (range 1V or higher) to the collector of Q3 via a suitable isolating capacitor, say .01μF-0.1μF.

Next we must turn on the transmitter continuously by connecting a clip lead from pin 1 of IC1a to the 6V supply rail and by bridging the pushbutton switch.

Point the transducers toward a convenient flat surface about 30cm or so away and look for a meter reading. There may not be one but adjust VR1 until one is obtained, then peak it. The peak is quite sharp but easily set.

Calibration involves adjusting the clock oscillator (IC2c, IC2d) until the unit indicates correctly over a measured distance. The exact distance is not important, but between two and three metres is probably the most convenient. Choose a flat wall, with clear surroundings, and measure from about halfway along the transducer body.

Performance

How well does the unit work in typical, practical situations? What is its range? How accurate is it? And how reliable is its performance?

Its range, under the most favourable conditions, would appear to be about seven metres. When the range is exceeded the readout shows "888". Fairly obviously, the range will be affected by the nature of the reflecting surface, and our seven metre measurement was made from a a large painted brick wall, in a clear area, at right angles to the line of propagation.

Softer surfaces, or those at an angle, will generally reduce this range, and something between three and four metres would be a more reasonable range to expect consistently. Also, as we hinted above, the reflecting surface needs to be fairly large (say one square metre or more) and the surrounding area reasonably clear of other large objects.

Given an acceptable set-up, the accuracy is quite high; of the order of one or two centimetres, even at five or six metres. As is usual with digital readout systems, the last digit may dither to some extent, presenting an ambiguity of about one centimetre, plus or minus.

As to the reliability of the readings, a great deal depends on the surroundings. While there is little doubt that the measurement it shows is an accurate one for the reflection it is receiving, this reflection may not always be the wanted one. The beam from the transducer is quite broad so that the reflected signal may come from objects well to one side of the intended line of measurement.

We conducted some experiments with small cardboard horns on one or both transducers, in an effort to reduce the beam width, but results were inconclusive. Some other material, more suited to these frequencies, may do a better job, and the reader may care to experiment.

One situation which it does not like is a long narrow hallway, particularly with doors in the side walls. Reflections from the walls, or from the door frames, will almost certainly confuse the measurement.

Similarly, a room full of furniture can cause all kinds of confusing reflections and produce obviously silly readings. In some cases this can be avoided by choosing an obviously clear path, or by working from one end of the room in preference to the other. Similarly, holding the unit as high as possible may help get the signal over the top of the furniture.

We estimate that the current cost of components for this project is approximately

$48

This includes sales tax.

DAVID REID ELECTRONICS

IF YOU'RE INTO ELECTRONICS COME IN AND SEE US!

WE'RE A POSITIVE FORCE IN SYDNEY AND THE LARGEST ELECTRONICS DISTRIBUTOR IN NEW ZEALAND — WITH THOUSANDS OF ELECTRONIC PRODUCTS, COMPONENTS AND ACCESSORIES

YOU'LL SEE THE SIGN

DAVID REID ELECTRONICS LIMITED

Takapuna • Auckland City • Te Papapa
Hamilton • Palmerston North • Lower Hutt
Wellington • Christchurch • Dunedin.

NORRIE 1478

why the top speaker manufacturers use AUDAX DRIVERS

Manufacturers like Spendor, KEF, Meridian, and I.M.F. all have fine reputations to maintain, reputations which can't be compromised with second rate components. So they choose AUDAX LOUDSPEAKER DRIVERS for consistency of quality, excellent powerhandling, low distortion, high efficiency — the list goes on and on. So when you construct your next loudspeaker project remember AUDAX, one of the world's largest and most respected names in loudspeaker technology. Phone or write for information on Audax loudspeakers, speaker systems and speaker kits.

AUDAX LOUDSPEAKERS

Head Office — Rear 295 Huntingdale Road, Huntingdale Vic. 3166 ph. 03 543 5266
Sydney — Suite 2B-2, 10 Bridge Street, Granville 2142 ph. 02 682 4133

AUDAX

TOTALIZATOR AGENCY BOARD
OF VICTORIA

TAB

The Victoria Totalizator Agency Board offers for sale a quantity of

POWER SUPPLIES

The supplies produce the following voltage with an input of 240 volts AC.

DC −5 volts at 250 MA
DC +5 volts at 6 amps
DC +40 volts at 4 amps

The power supply is a standard 19 inch mounted device suitable for commercial or home hobby applications.

Enquiries to John Watt — (03) 268 2236

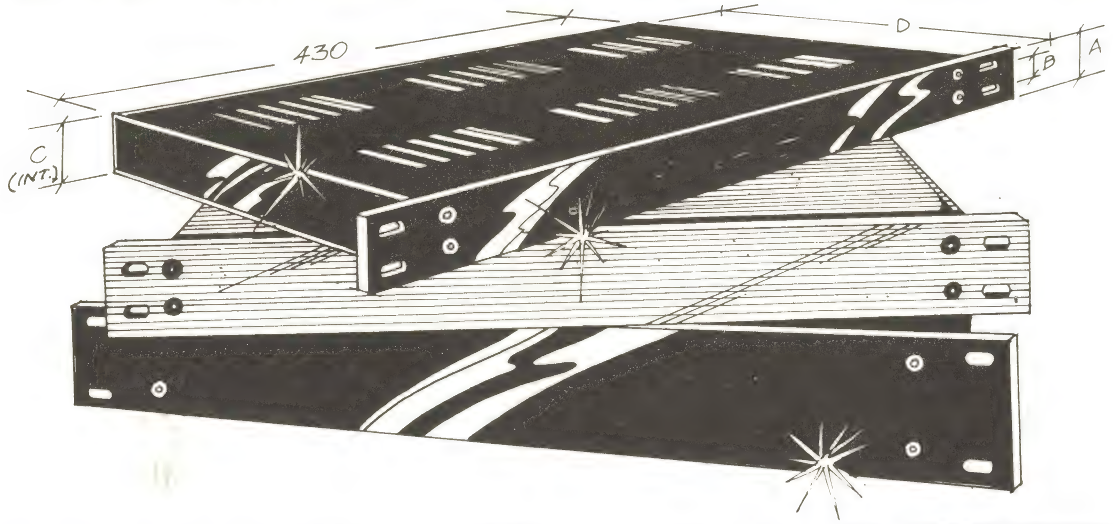
Sale will be on an "As Is" basis.

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS. ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

YOUR BUDGET PROBABLY WILL ~~WON'T~~ STRETCH TO AFFORD OUR PROFESSIONAL SERIES ALL ALUMINIUM RACK CABINETS

NOW YOUR PREAMPS, AMPS, CONTROL MODULES MONITOR PANELS ETC. CAN LOOK EVERY BIT AS GOOD AS TECHNICS, NAKAMICHI AND OTHER TOP MANUFACTURERS



THREE YEARS AGO or so we were selling nicely finished racking cabinets for around $60–$70 but, alas the maker kept increasing the prices until we would have had to sell them for a price way beyond the reach of the average constructor — so, sadly we discontinued the range.

MASS PRODUCTION TOOL UP SLASHES COSTS Well, of course, the demand for our rack cabinets continued, so to meet the challenge of high labour and handling costs we have tooled up with all the necessary dies etc. to mass produce high quality prescision finish rack cabinets to International Dimension Standards with remarkable cost savings.

SIX NATURAL AND BLACK FINISH MODELS The Black or Natural finish cabinets are each available in 44mm, 88mm or 132mm high models. Mounting hole centres conform exactly to International racking specifications both vertically and horizontally.

* These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance. * All aluminium construction. * REMOVABLE TOP AND BOTTOM PANELS. * All dimensioning conforms to the International standard. * Natural or Black finish. * Ventilated lid. * Deluxe brushed finish anodised front panel. * Individually cartoned. *Supplied in Flat Pack Form — Easily assembled in minutes.

Side Elevation:
D = 254mm C(Internal Chassis Height)
B (Mounting Bolt Centres)

INTRODUCTORY PRICES

Cat. No.	Finish	A	B	C	PRICE	5 or More
H 0401	Natural	44	34	38	$39.50	$38.00
H 0402	Natural	88	57	82	45.00	42.50
H 0403	Natural	132	89	126	49.50	45.00
H 0411	Black	44	34	38	39.50	38.00
H 0412	Black	88	57	82	45.00	42.50
H 0413	Black	132	89	126	49.50	45.00

Beware of other rack boxes that do not conform to international rack sizing.

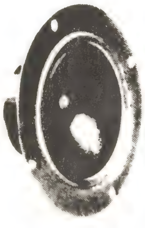
AT DOUBLE THE PRICE OUR DAINICHI HIGH FIDELITY SPEAKERS WOULD STILL REPRESENT OUTSTANDING VALUE

Altronics have teamed up with one of Japans most respected speaker designer/manufacturers (Dainichi manufacture OEM speakers for Pioneer) The result, an outstanding range of pure fidelity speakers available to you at IMPORT PRICES for which we will no doubt incur the wrath of our competitors.

CONE TWEETER 50 WATT

50 watt max. power 8 OHM Z.

Amazing performance budget price. Frequency response 2 KHZ-18 KHZ. 110mm Diam. Hole centres 79 mm. Australia's best value at this price.



C 3020 . . . .$7.50
4 or more $7.00

DOME TWEETER 60 WATT

60 watt max. power.

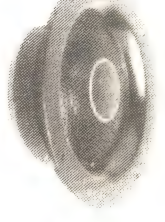
Silky smooth frequency response. 1.5 KHZ to 20 KHZ. Wide Angle dispersion. Massive power handling capacity. Diam. 94 mm. *High spectrum. Purity. Incredible low price!*

C 3010 . . . .$14.50
4 or more $13.50

MIDRANGE 50 WATT

Midrange clarity that has to be heard to be appreciated!

Absolutely 1st class reproduction of midrange — piano, vocal, guitar, violin etc. **Huge 50 watts max. input.** 8 OHM. Frequency response 700 - 5 KHZ. *Value Plus!*

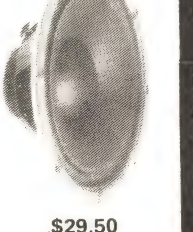


C 3030 . . . .$17.50
4 or more $16.90

WOOFER 307 mm (12 in.)

40 watts max. power 8 OHM.

Roll edge cone suspension. Resonant to 30 HZ. Frequency range 30-2 KHZ. Smooth, faithfull bass speaker. **Ideal Hi-Fi replacement.** 48 mm voice coil.



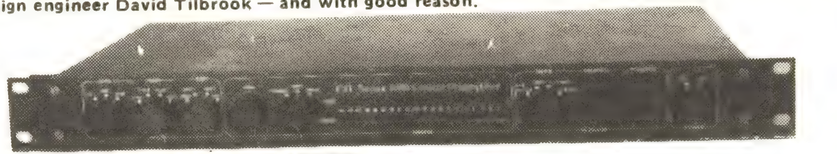
C 3040 . . . .$29.50
4 or more $27.50

BANKCARD JETSERVICE-DELIVERY NEXT DAY BANKCARD JETSERVICE-

ALTRONICS ... ALTRONICS ... ALTRONICS ... ALTRONICS ...

STUDIO FORMAT
ETI 5000 STEREO CONTROL PREAMPLIFIER

There have been countless accolades exclaiming this brilliant design by Australia's top audio design engineer David Tilbrook — and with good reason.



SHEER SUPERB SOUND CLARITY

Together with noise levels that would do studio equipment proud.

PART OF THE SECRET IS . . .

the use of very fast response time "State of the art" OP amp semis, which have only become readily available in recent times.

As a demonstration of our faith in this classic designed preamplifier we proudly release the **STUDIO FORMAT 5000 PREAMP** which includes some very worthwhile refinements as detailed here:—

- ★ Gold plated RCA Jacks on all phono inputs.
- ★ 1 x pair gold plated RCA Line Plugs, supplied.
- ★ Military spec. National Semiconductor LM 394's employed.
- ★ Low capacitance screened cable, supplied; IC sockets provided throughout; Multicoloured led display.
- ★ Metal film 1% resistors used throughout all audio circuitry.
- ★ Pretinned PCB's.
- ★ Satin Black brush finished, aluminium control knobs.

FREE FREIGHT DELIVERY ON THESE ALTRONICS KITS AUGUST ONLY.

FACILITIES AND SPECIFICATIONS

Inputs

Low Level — Moving coil, moving magnet 1, moving magnet 2.
High Level — Tuner, Aux 1, Aux 2.
Tape — Tape 1, Tape 2.
Calibration — Inbuilt 400HZ Oscillator.

Led Level Meters

Mode selection to — Source, tape 1 record level, tape 2 record level.
Range — Calibrated — 48 to + 9db.
Display — Peak and average level simultaneously.
Frequency Response 15 HZ — 130 KHZ + 0db — 1DB.
Distortion — Less than .003% all inputs.
S/N Ratio — Greater than 100 db (A weighted) High Level IP/S.
Greater than 92 db (A weighted) Moving Magnet IP.
Greater than 75 db (A weighted) Moving Coil IP.
Monitor Output — Enables comparison of record level to source levels.

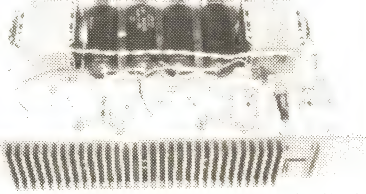
DELUXE STUDIO FORMAT 5000 PREAMP KIT K 5001 . . . $275.00

Complete kit includes all ETI specified parts plus the Studio Format Package.
Full instruction booklet included.

SEE ETI MAGAZINE JULY '81—OCT. '81 FOR FULL DETAILS.

ETI 5000 STEREO MOSFET AMPLIFIER

See ETI magazine Jan. '81—April '81. New generation mosfet power semis facilitate David Tilbrook's classic power amplifier. Listening tests prove it surpasses even the best in conventional amplifiers in low fatigue, high definition audio. Completely uncoloured crisp sound purity.



EVEN BETTER: This beautifully engineered amp design is based principally on two identical printed circuit boards with a minimum of other wiring, thus enabling even a relative "beginner" to accomplish building this project as long as the step by step instructions are followed.

The Altronics Kit includes the DELUXE FINISH FRONT PANEL HEATSINK.

★ Original specified chassis bar design case. ★ All metal work finished satin black. ★ Flux shorting strap transformers used to minimise hum ★ Low leakage power supply electrolytics used.

SPECIFICATIONS:

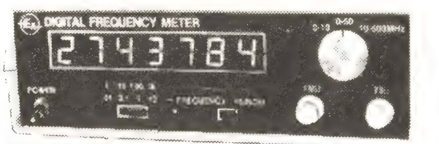
Power Output: 100 watts into 8 ohms x 2. **Frequency Response:** 8 HZ - 20 KHZ + 0db — .4db.
Noise: 116 db below full output. **Input sensitivity:** IV RMS for 100 W output.
DISTORTION: Less than .001% at 1 KHZ and full output.
STABILITY: Unconditional stable.

COMPLETE MOSFET AMP KIT K 5005 . . . . **$289.00**

DIGITAL FREQUENCY METER

See Electronics Aust. Mag. Dec. 81-Feb. '82

500 MHZ, 7 DIGIT RESOLUTION PLUS PERIOD MEASUREMENT FEATURE



IMPORTANT NOTES:

(1) This project is well within the scope of the "not so experienced" as virtually all components are contained on a single PCB.

(2) **ALTRONICS USE ONLY THE SPECIFIED INTERSCIL LSI — BEWARE OF INFERIOR KITS THAT DO NOT CONFORM TO THE ORIGINAL DESIGN.**

★ Prepunched and screened front panel, no drilling or filling required. ★ Bright high efficiency 7 segment display. ★ Frequency ranges 0-10MHz, 0-50MHz, 10-50MHz (with optional pre-scaler) ★ 4 gating times — 01, .1, 1, 10 seconds. ★ 4 period measuring ranges 1, 10, 100 and 1000 input cycles give 0.1uS resolution. ★ High input sensitivity — 10mV to 30MHz, 100mV at 50MHz @ 1M input impedance, 200mV at 500MHz @ 75 ohms input impedance. ★ High accuracy — typically better than .005%/count uncalibrated.

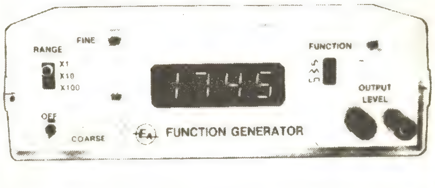
Costs a fraction of commercial counters.

EXCLUSIVE ALTRONICS KIT FEATURES:

- ★ IC sockets provided throughout.
- ★ Low aging 10,000 MHZ XTAL.
- ★ Thermalloy heatsink for 5V regulator.
- ★ Quality Pactec Instrument Case

K 2500 (50 MHZ version) **$119.50**
K 2501 Pre-scaler . . . . **$ 26.00**
(add for 500 MHZ version)

FUNCTION GENERATOR WITH DIGITAL DISPLAY



EA's new Function Generator covers the frequency range from 15Hz to 170kHz in three ranges with coarse and fine frequency controls. An economical 4-digit display has been incorporated to eliminate dial calibration. Sine wave distortion can be trimmed to around 0.5%.

See EA April, 1982

K 2505 . . . . **$79.50**

ALTRONICS POWER SUPPLY

BASED ON EA LM 317K PROJECT
Every workshop, school and hobbyist should get one now!

- ★ Overload and short circuit protected.
- ★ Full voltage and current metering.
- ★ 3-32 volt output at 1 AMP.
- ★ Uses LM 317K variable regulator.
- ★ Full instructions and every last part included.

VALUE PLUS!

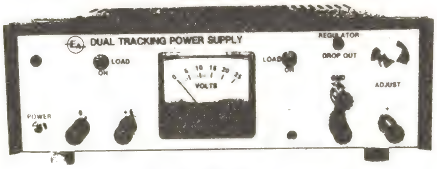
K 3200 . . . . **$39.95**

DIGITAL CAPACITANCE METER

Electronics Australia Project. Measures 1PF — 99.99 UF. 240V Mains Powered. Bright LED Display. Easy to build. Complete kit of parts and full instructions.

K 2520 . . . . **$45.00**

DUAL TRACKING POWER SUPPLY



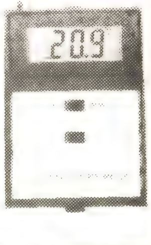
+ and — 22V up to 2 AMPS
+ 5V at .9 AMP
Fully Protected against short circuits, overloads and thermal runaway.
See EA March, 1982

K 2507 . . . . **$86.00**

DIGITAL THERMOMETER LCD

See EA Feb. '82, Fantastic new project. ★ 1°C Resolution ★ Has inbuilt sensor for portable use ★ External sensor capacity allows measurement of fish tanks, heatsinks etc. Uses brand new DPM-200 15mm LCD Display. Easy to build.

K 2530 . . . **$69.50**



FOR ADDRESS & DESPATCH DETAILS SEE PAGES 16 & 17

Put an end to interference problems

RFI shielding for the System-80

Widespread use of computers in the home has alerted many users to the problems posed by radio frequency interference from high speed digital circuitry. If your computer is causing problems with your own or your neighbour's TV reception, you can do something about it! A reader describes his approach.

by BRIAN J. WARMAN VK5BI

After a lot of thought I selected the Dick Smith System-80 as the personal computer I'd most like to own. It had an in-built tape deck, level control and meter for overcoming all of those problems one may have loading programs from other sources, and perhaps most importantly it used the same software as the TRS 80.

Eventually the great day came when my machine arrived. I sat down with the kids and we played the games supplied on the demonstration tape. My wife did not however appreciate the lemon coloured lines which now appeared on the TV set whenever the System-80 was switched on. Nor it transpired did my next door neighbour; (he doesn't know it was me but a casual comment confirmed the same trouble).

My amateur shack is at the bottom of the yard and a quick tune around the bands confirmed my worst suspicions in that line. The thing was hot! It certainly would not be of any use to me as a terminal for my radioteletype; and this was one of my reasons for purchasing a computer. Something had to be done!

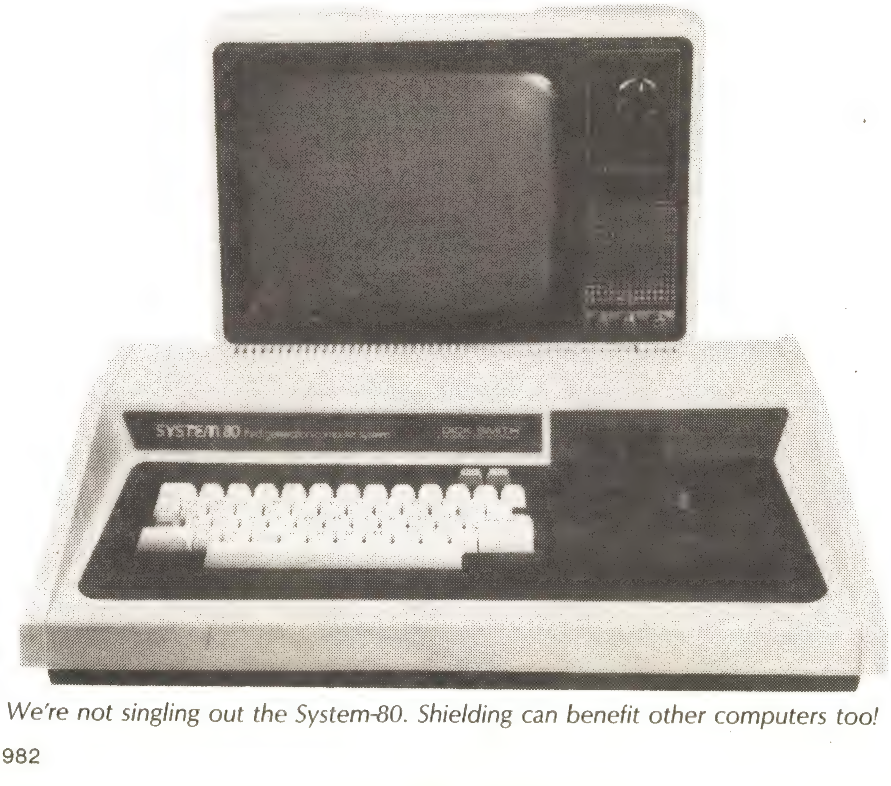
As a first step I removed the top of the case so that the innards were displayed. (I would have eventually done this anyway). This is easily accomplished by removing eight screws from the underside of the case.

Three of the screws are along the back edge of the bottom of the case. Two are exposed, while the one in the rear righthand corner is countersunk by about 30mm. The three screws along the front edge of the bottom of the case are likewise countersunk. One other screw is countersunk immediately to the left of the label on the bottom of the machine, while the final one is towards the rear to the left of the raised plastic support ridge to the left of the label and is also countersunk.

Do not remove the screw in the centre of the lefthand support ridge. This screw secures internal components of the computer. With the eight screws removed and stored in a safe place, carefully turn the System-80 right side up. Prise the lid up at the front first and position it so that it clears the cassette recorder keys. The lid must then be pushed rearwards so that the Reset and video cut buttons are cleared and then it may be lifted off.

The five main parts comprising the System-80 are now exposed. These consist of the CPU board at the left, the interface board, tape recorder on the right, above that the power supply enclosure and the keyboard. These units are of course interconnected; the power supply and cassette by plug and socket, the rest by ribbon cable and connectors. The CPU, interface board, and keyboard may be removed as one unit. Remove eight screws from the keyboard, and three each from the other two boards. Also unplug the power supply and cassette mechanism. Note that one of the screws is beneath the ribbon cable interconnecting the two boards.

Next remove the cassette mechanism (five screws). The power supply is secured by three screws and may be withdrawn to the rear of the base.



We're not singling out the System-80. Shielding can benefit other computers too!

The next step is to obtain some aluminium cooking foil plus a piece of aluminium flywire approx 20 × 40cm. Measure a piece of flywire and bend it to fit the shape of the vents in the top of the case. It may be secured by tinned copper ties. The bottom vents are similarly treated. Cut a further piece of flywire and form it in the shape of a "U" to the power supply compartment, (bottom and sides). Contact adhesive is used to secure aluminium foil to the inside of the remainder of the case. Don't forget to attach a piece to the front of the power supply compartment. Fold this piece over into the main compartment so that it contacts the rest. Of course it is important that all pieces are in contact; leave enough foil so that it overlaps the edge of the base in order that contact will be made with the top when it is replaced.

Now replace all units. Pay particular attention to the terminations on the ribbon cable. The wires just push in so that they are fairly easily displaced. Remove the four screws and perforated cover from the power supply enclosure. Remove the two screws securing the board and unsolder the 240V leads from the board. Thread some ferrite beads on to each lead or, alternatively thread both leads through a small ferrite ring. Resolder and replace the board.

Remove about 30cm of braid from some shielded cable. Cut a piece and connect it between the case of the RF modulator on the interface board and mains earth. You will find this mains earth lead soldered to one of the transformers in the power supply enclosure. Solder another piece of braid between the keyboard chassis and the cassette recorder frame, and between this point and the aluminium foil of the base.

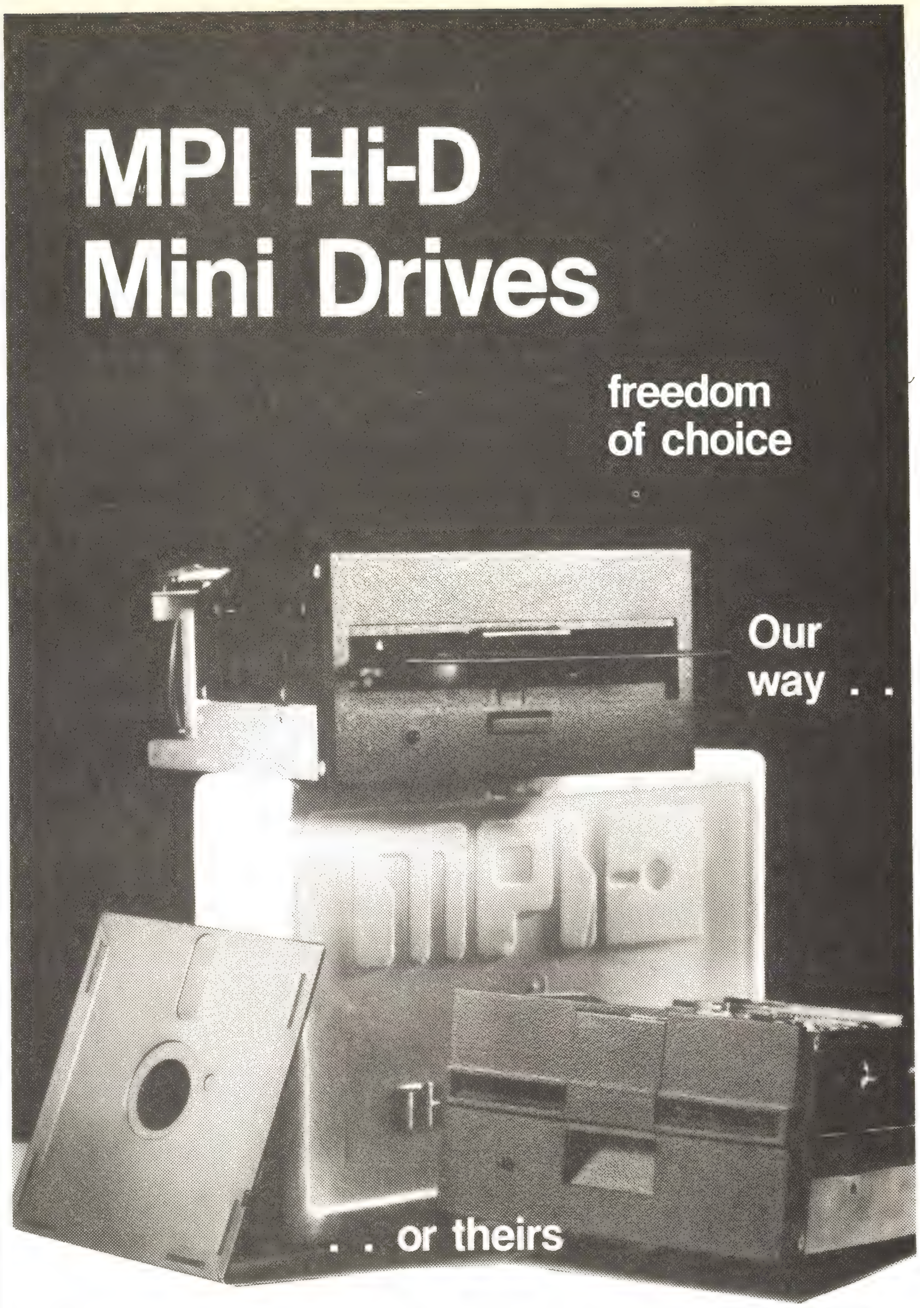
Carefully examine all boards to ensure there is no contact with the foil. Particular attention should be paid to the cassette player board; it may be necessary to slip a little cardboard underneath just to be sure before reassembling the computer.

An improvement? Well I am now able to use a portable radio on the table along side the computer with no problems.

Another point of course is that if it can't get out, it can't get in. This means I am able to run my amateur transmitter without interfering with the computer.

Editorial note:

As far as production of radio frequency interference is concerned, the System-80 computer is no better and no worse than many other small computers on the market. The same techniques can be used on any computer and should provide an effective answer to the problem of computer-generated RFI.



Professional, push-button disk eject, or industry standard flip-front . . . Either way, MPI builds the quality in. Head load for media protection, 6mSec track-to-track and a choice between 48, 96, 100TPI, single or double sided 5¼" Floppy Drives.

TRUE FREEDOM OF CHOICE.

Authorised Dealers:

Sydney: (02) E&M Electronics 51 5880, Applied Technology 487 2711, QT Computers 29 5599, Micro Repair 747 1061, Computer Components 868 3614, **Wollongong:** (042) Macelec 29 1455. **Brisbane:** (07) Baltec 36 5183. **A.C.T.:** (062) Ortex 80 5283. Boulevard 48 5411. **Perth:** (09) Micro Controls 325 2444, Electronic Systems 335 7313. **Adelaide:** (08) DC Electronics 223 6946, Micro'80 211 7244. **Melbourne:** (03) Stewart Electronics 543 3733, Ellistronics 602 3282, Ritronics 489 8131, Pennywise Peripherals 82 2389, De Forest Software 877 6946, Comp-Soft 428 5269. **Tasmania:** Coastal Computers (004) 31 3259.

daneva australia pty ltd.

66 Bay Road, Sandringham, Vic., 3191.
Ph: 598 5622. Telex: AA34439

Adding graphics to the Super-80

EL Graphix, of Croydon, Victoria, has come up with a series of graphics add-on boards for the Super-80 that will interest all users of this popular do-it-yourself computer. Double screen resolution is just one possibility!

by PETER VERNON

Three kit versions of the board are available. One provides special graphics characters ranging from card suits, lines and stick figures to quarter character cell size blocks which allow a screen resolution of 64 × 32.

Kit number two provides "chunky" graphics similar to those of the TRS80 Model 1 and the Dick Smith System 80. This kit makes possible a screen resolution of 64 × 48 blocks, but does not include the card suits and other games graphics of kit one.

A third version of the kit uses a 2732 EPROM to provide both the character sets of kits one and two. With this board either of 64 graphics characters can be selected under software control, although only one set can be used at a time. Cost of kit three is $49.50 as compared to $39.50 for kits one and two. Post and packing costs $2.

Construction and installation

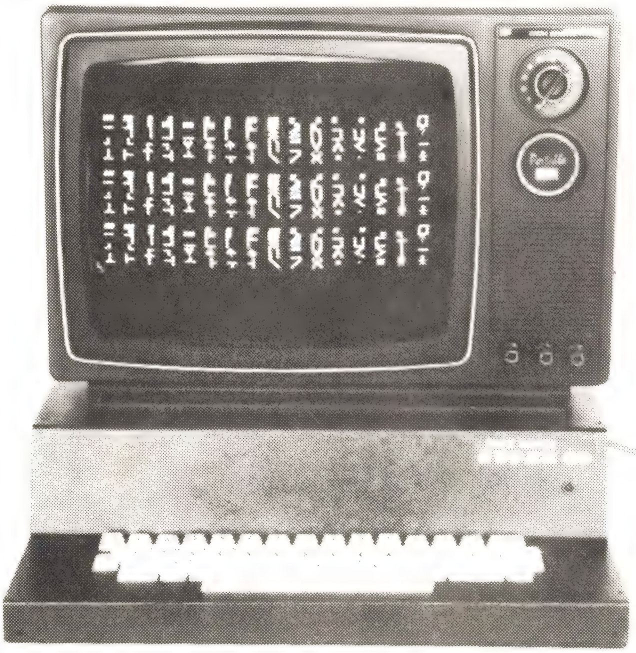
The kits replace the existing character generator of the Super-80 with a preprogrammed EPROM containing the standard alphanumerics and the new graphics characters. However, each of the graphics characters are designed on an 8 × 10 dot matrix instead of the 5 × 8 matrix of the original character generator, so the character scanning hardware must also be modified.

Each kit consists of a printed circuit board measuring 80mm × 66mm, an EPROM, a replacement for shift register U23 of the Super-80 and miscellaneous wires and sockets. Solder is provided.

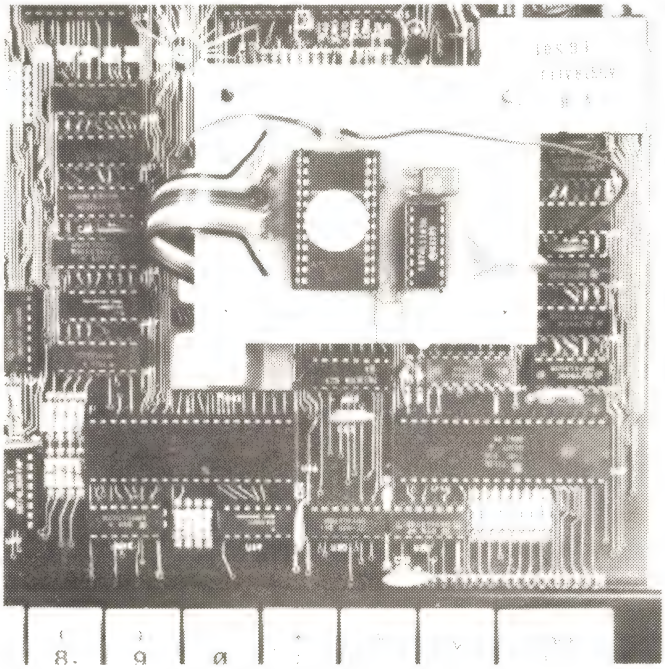
Assembly is straightforward as long as the instructions are followed carefully. A low power soldering iron with a fine tip is essential for construction.

Once assembled the graphics PCB is connected to the Super-80 board by ribbon cable terminated by two DIP headers. A 24-pin DIP header replaces the original character generator supplied with the Super-80, while a 16-pin header replaces U23 on the main board. Two other flying leads from the add-on board are soldered directly to pins of ICs on the Super-80 board.

EL Graphix suggests that the add-on board be mounted on the video modulator of the Super-80, and provide nuts and bolts for this purpose. This method of mounting places the PCB over the sockets to which it is connected, and is "crude but effective", as



This screen display illustrates three sets of the 64 graphics characters provided by EL Graphix's kit 1.



The add-on board is installed above the existing character generator socket, bolted to the top of the video modulator.

the EL Graphix instruction sheets put it.

Perhaps a better idea if your Super-80 is installed in a case is to mount the new board on a small bracket secured to the side of the case. Alternatively it could be mounted on the bottom of the case, using nuts and bolts with stand-offs.

Whatever method you use make sure that none of the tracks on the new board are short circuited by the mounting hardware, and make sure that the add-on board does not contact any part of the Super-80 PCB except for the connections specified.

Testing and examples

On switching on the Super-80 with the new board installed you should see a new cursor, a small "EL" graphic, flashing in place of the usual Basic cursor.

Use the statement PRINT [A1 160] to see the first of the new graphics characters. The 64 characters have ASCII codes from 160 to 223, and can be printed or POKEd in the same way as any other ASCII character. The instruction sheets provide a number of sample programs for testing the graphics board.

Double screen resolution

Using the 16 block graphics characters from kit one, it is possible to double the screen resolution of the Super-80; to 64 points horizontally by 32 points vertically. The second half of the assembly language program in listing 1 does this by taking a pair of co-ordinates and calculating the screen location. It then selects the appropriate graphics character to set or reset a quarter of a character block corresponding to the co-ordinates specified.

Since there are 16 possible combinations of the four points in each character cell, 16 separate graphics characters are used, selected from the table which concludes listing 1.

The origin of the co-ordinate system is in the upper left hand side of the screen, and the program as given is set up for a Super-80 with 48K of RAM. To use it in a machine with less memory, change the value at location 008D of the program from BE to 3E for 16K or 7E for 32K.

The first half of the program in listing 1 adds the capability to draw lines. Given the co-ordinates of the start and end points of the line it calculates all the points in between and calls the DOT routine to draw the line. Since this is an assembly language program, it is quite fast.

To allow us to erase dot points or lines, one byte of the program is a "flag" called MODE. When this location (196 in decimal) is set to "1" a point will be displayed. When MODE is "0" the

Double screen resolution program

```
0000          11 00 00      LD DE,START
0003          21 00 00      LD HL,END
0006          CD 10 00      CALL LINE1
0009          C9            RET


000A          11 00 00      LD DE,POINT
000D          C3 70 00      JP 0070   PLOT POINT


0010  LINE1   01 00 00      LD BC,0000
0013          C5            PUSH BC
0014          7A            LD A,D
0015          BC            CP H
0016          DA 22 00      JP C,L2
0019          C2 21 00      JP NZ,L1
001C          7B            LD A,E
001D          BD            CP L
001E          DA 22 00      JP C,L2
0021   L1     EB            EX DE,HL
0022   L2     44            LD B,H
0023          4D            LD C,L
0024          21 43 00      LD HL,I4
0027          36 3C         LD(HL),3C
0029          7B            LD A,E
002A          B9            CP C
002B          DA 30 00      JP C, L3
002E          36 0C         LD(HL),0C
0030   L3     7A            LD A,D
0031          B8            CP B
0032          CA 49 00      JP Z, L5
0035          C5            PUSH BC
0036          80            ADD B
0037          1F            RRA
0038          47            LD B,A
0039          3C            INC A
003A          67            LD H,A
003B          7B            LD A,E
003C          B9            CP C
003D          CA 44 00      JP Z, L4
0040   L6     81            ADD C
0041          1F            RRA
0042          4F            LD C,A
0043   I4     3C            INC A
0044   L4     6F            LD L,A
0045          E5            PUSH HL
0046          C3 30 00      JP L3
0049   L5     7B            LD A,E
004A          B9            CP C
004B          CA 53 00      JP Z,G1
004E          C5            PUSH BC
004F          62            LD H,D
0050          C3 40 00      JP L6
0053   G1     CD 70 00      CALL DOT1
```

listing continued ►

specified point will be turned off. Since the dot routine is used by LINE, mode allows lines to be either plotted or erased as well.

LINE takes two pairs of co-ordinates, the starting point in the DE register of the processor and the end point in HL. The short routine at location 0000 to 0009 actually loads the co-ordinate pairs into the appropriate registers and then calls the line drawing routine.

For example, suppose that A and B are the X and Y co-ordinates of the starting point and C and D are the co-ordinates of the end point of a line. Put A in location 0002, B in location 0001, C in location 0005 and D in location 0004, then run the program from 0000. See the subroutine at line 1000 of listing 2.

To plot a single point put the X co-ordinate in location 000C and the Y co-ordinate in location 000B, then run the program from 000A. The subroutine at line 2000 of listing 2 does this. When using the assembly language program in your own Basic programs, don't forget to set "MODE" at location 00C4 (196 decimal) to display or erase.

The program in listing 2 first draws a border around the screen by reading a list of start and end points from DATA statements, then calling the subroutine at line 1000 which draws the lines. After the border the program displays 100 individual points at random co-ordinates using the subroutine at line 2000.

Going on

The programs given here are just one example of what can be done with the graphics. By drawing lines and dots and combining them with other graphics characters provided by the kit complex pictures can be built up. By plotting in two or more areas of memory and displaying them in sequence, animated scenes can be constructed.

The EL Graphix kits seem like a worthwhile addition to the Super-80. Which version you choose depends on your own particular requirements, but they are all well designed, easy to install and simple to use. They can open up a whole new range of capabilities for your computer.

For more information contact EL Graphix, PO Box 278, Croydon, Vic 3136.

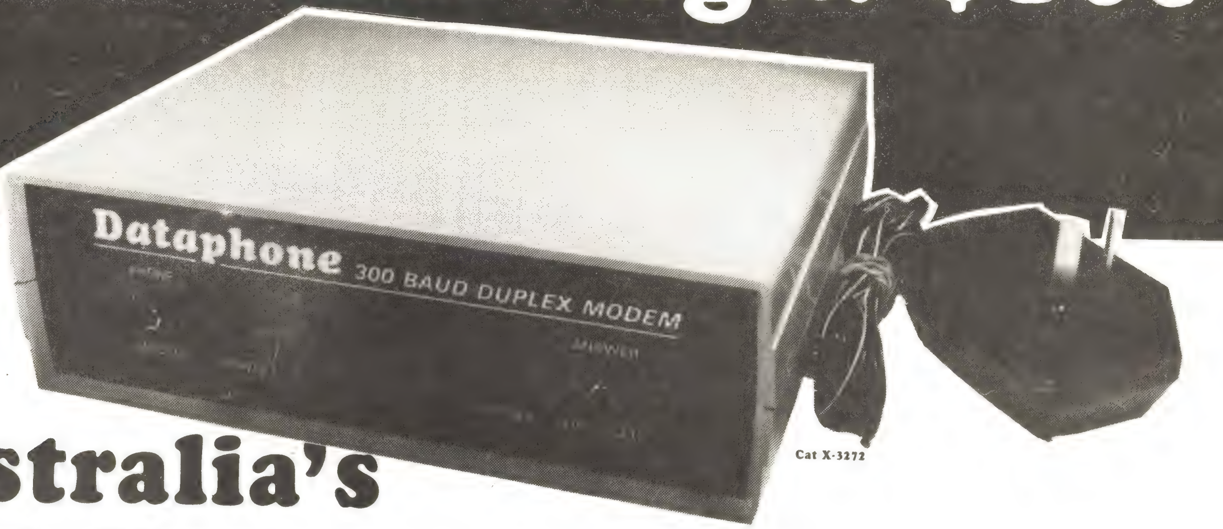
NOTE: The DOT portion of the program here is similar to a program for the Sorcerer computer which appeared in the US magazine "Creative Computing", January, 1981. The workings of the LINE routine are explained in a short article in "Byte" magazine for October, 1980 called "Vector graphics for Raster Displays".

```
0056        D1              POP DE
0057        7A              LD A,D
0058        B3              OR E
0059        C8              RET Z
005A        C1              POP BC
005B        C3 30 00        JP L3
005F        00


0070 DOT1   AF              XOR A
0071        CB 3B           SRL E
0073        8F              ADC A,A
0074        CB 3A           SRL D
0076        8F              ADC A,A
0077        0E 01           LD C,01
0079        B7              OR A
007A        28 05           JR Z,P1
007C   P2   CB 21           SLA C
007E        3D              DEC A
007F        20 FB           JR NZ P2
0081   P1   67              LD H,A
0082        6B              LD L,E
0083        3E 05           LD A,05
0085   P3   29              ADD HL,HL
0086        3D              DEC A
0087        20 FC           JR NZ,P3
0089        5A              LD E,D
008A        57              LD D,A
008B        19              ADD HL,DE
008C        11 00 BE        LD DE,BE00
008F        19              ADD HL,DE
0090        57              LD D,A
0091        5E              LD E,(HL)
0092        DD 21 C5 00     LD IX,TABLE
0096   P4   DD 7E 00        LD A,(IX+0)
0099        B7              OR A
009A        28 08           JR Z,S1
009C        BB              CP E
009D        28 06           JR Z,S2
009F        14              INC D
00A0        DD 23           INC IX
00A2        18 F2           JR P4
00A4   S1   57              LD D,A
00A5   S2   3A C4 00        LD A,(MODE)
00A8        B7              OR A
00A9        28 04           JR Z,S3
00AB        7A              LD A,D
00AC        B1              OR C
00AD        18 03           JR S4
00AF   S3   79              LD A,C
00B0        2F              CPL
00B1        A2              AND D
00B2   S4   57              LD D,A
00B3        DD 21 C4 00     LD IX,TABLE-1
00B7        14              INC D
00B8        DD 23           INC IX
00BA   S5   15              DEC D
```

listing continued on p 93 ►

At last!

Don't pay $400! Unbelievable price breakthrough: $169



Cat X-3272

Australia's first direct modem to meet new Telecom regulations!

The data communications revolution has now reached Australia. More and more personal computer users are communicating with other computers via the telephone network, to exchange data and programs with other personal computer users and to access the growing amount of valuable information in the big computer "data bases".

Until now, the only type of telephone modem available for use with personal computers has been the acoustic coupled type. These are expensive, and also depend heavily on the telephone's old-fashioned carbon microphone. As a result even the best units of this type are often not capable of really reliable, trouble-free operation. But now, after months of development work and negotiation with Telecom Australia, Dick Smith Electronics presents the Dataphone – a telephone modem that really is suitable for personal computers. It's not an acoustic-coupled type, but a true high performance direct connect modem. And it's authorised by Telecom. Even more importantly, it will cost you less than half the price of a comparable acoustic modem!

Here are just some of Dataphone's many exciting features:

★ Simple plug-in connections.
★ Full duplex operation for speed and convenience.
★ Operates at the standard data rate of 300 baud.
★ Designed and manufactured in Australia.
★ Standard RS 232C interface – so it can be used with almost any personal computer.
★ Fully complies with both Telecom regulations and CCITT Recommendation V.21 – hence it is not only legal, but also fully compatible with other modems. (Telecom Authorisation No. C82/37/557).
★ Operates in either Answer or Originate mode, at the flick of a switch, for complete flexibility.
★ Has a phone/modem switch, for convenient operation.
★ Comes complete with approved power supply and detailed, easy to understand user manual.

And the best news of all - it costs only **$169**

DICK SMITH Electronics

bankcard

HFC

See Page 124 for address details

DSE A304 PAI

SBC THE NEW 800

Z80 S100 SINGLE BOARD COMPUTER

The SBC-800 is a S100 Z80 Single Board Computer with dual serial ports, Real time clock, on board Ram & Eprom, for use as the main CPU card in a Microcomputer.

The SBC-800, a very powerful Single Board Computer, provides all of the necessary facilities needed for a standalone processor.

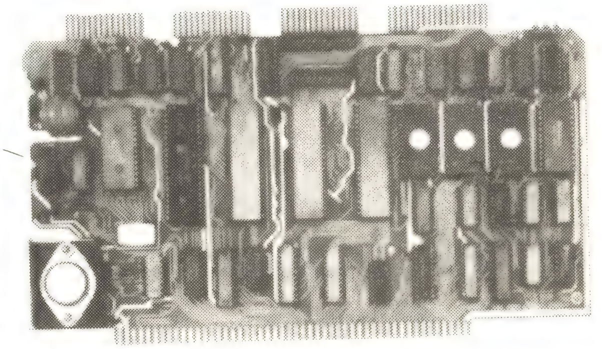
The heart of the board is a Z-80 Microprocessor. Running at 4 Mhz, the processor communicates with all of the SME Systems range of boards. The board includes a CTC counter timer, for generating the baud rates for the 2 serial ports on board, as well as 2 vector interrupt driven channels for off board interrupt processing, or on board timing functions.

Serial I/O consists of a DART which provides 2 serial ports which may be modems, terminals or printers. Each one of these serial ports operates independently of the other.

Parallel I/O consists of a pair of 8255, Programmable Perip-heral Interfaces. The first of these devices provides all the I/O lines necessary to talk with the Centronics Port, as well as the on board Real Time Clock. The second device, provides up to 22 general purpose I/O lines which can be programmed in a number of different modes of operation.

The board also provides four 24 pin sockets for installing up to 16 Kbytes of Eprom, using 2732 devices, or 8 Kbytes of Eprom, using 2716 devices. The sockets have provision for installing 2 Kbytes of ram in up to 3 sockets, to provide 6 Kbytes of Static Ram in lieu of Eprom.

An on board, rechargeable battery, provides power for the Real Time Clock, as well as the CMOS static memory which has been fitted to the board.



FEATURES

- S100 Bus Compatible (IEEE 696)
- Z-80 Microprocessor running at 4 Mhz.
- Two Serial RS232 Communication Ports.
- Software programmable Baud rate generator.
- Parallel Centronics Printer Port.
- 22 Programmable, General Purpose I/O Lines.
- Real Time Clock, Battery backed.
- 2K CMOS ram standard, 6K option.
- Provision for up to 12K EPROM on board.
- Standby Rechargeable Battery on card.
- Power on Reset/Power Fail detect.
- Power on Jump to Monitor/Bios.
- On board memory disable.

SBC 400

The SBC-400 is a low cost CPU card for use in a system where the power of the SME Systems SBC-800 Single Board Computer is not required.

SBC-400 price reduced from $465 to **$395.**

SME SYSTEMS
S. M. ELECTRONICS

22 Queen Street.
Mitcham, Australia, 3132. Phone: (03) 874 3666 Telex: AA 37213

```
00BB          20 FB          JR NZ,S5
00BD          DD 7E 00       LD A,(IX+0)
00C0          77             LD (HL),A
00C1          C9             RET
00C2          00
00C3          00
00C4  MODE    01  (01 TO PLOT , 00 TO ERASE)
00C5  TABLE   20
00C6          AB
00C7          AC
00C8          A0
00C9          AE
00CA          A6
00CB          AA
00CC          A7
00CD          AD
00CE          A9
00CF          A2
00D0          A1
00D1          A4
00D2          A5
00D3          A3
00D4          A8
00D5          00
```

Listing 2: Basic example program

```
00010 CLS
00012 REM DRAW A SCREEN BORDER
00020 L=0
00030 READ A,B,C,D
00032 DATA 0,0,63,0
00034 DATA 63,0,63,31
00036 DATA 63,31,0,31
00038 DATA 0,31,0,0
00040 GOSUB 1000
00050 L=L+1:IF L<4 THEN GOTO 30
00060 REM
00070 REM DISPLAY 100 RANDOM DOTS
00072 D=0
00080 X=INT(RND*63)+1
00090 Y=INT(RND*31)+1
00100 GOSUB 2000
00110 D=D+1:IF D<100 THEN GOTO 80
00120 END
01000 REM SUBROUTINE FOR LINES
01010 REM
01020 POKE 1,B:POKE 2,A
01030 POKE 4,D:POKE 5,C
01040 POKE 196,1
01050 USR(0)
01060 RETURN
02000 REM SUBROUTINE FOR DOTS
02010 POKE 11,Y:POKE 12,X
02020 POKE 196,1
02030 USR(10)
02040 RETURN
```

JIL SX-200,
A BETTER SCANNING
MONITOR RECEIVER.

Covers 26-88 MHZ & 108-180 MHZ & 380-514 MHZ

Monitors over 33,000 frequencies from 26 to 88 MHz, 108 to 180 MHz and 380 to 514 MHz. Bands included within this range are HF and UHF CB, 27 and 155 MHz MARINE, Australian LOW BAND, AIRCRAFT band, VHF SATELLITE band, 10 Mx, 6 Mx, 2 Mx and 70CMx AMATEUR BANDS, VHF High BAND as well as UHF two-way band.

Mechanically rugged the SX-200 uses high quality double-side Epoxy-Glass printed circuit boards throughout. Some of its other outstanding features include 3 MODE SQUELCH circuitry which allows the lockout of spurious and carrier only signals, extremely low spurious count, AM and FM detection on all bands, FINE TUNING control for off channel stations, 240 VAC on 12 Volt DC operation, Accurate QUARTZ CLOCK, Squelch operated OUTPUT for switching a tape recorder etc, 16 Memory channels, MEMORY BACKUP which lasts up to two years, high SENSITIVITY and SIGNAL-TO-NOISE ratio on all bands, CRYSTAL FILTER for excellent SELECTIVITY and easy servicability due to component layout as well as a 90 day warranty.

Its high quality and performance is testified by the fact that it is in use by a large number of State government and Federal bodies including most state and federal police departments.

Contact GFS, the Australian Distributors, or our interstate outlets for full technical specifications.

We also market a range of pocket scanning receivers and transceivers. Contact us for full details.

PRICE $512 INCL S.T.+$8 P&P
SERVICE MANUAL $10+$1 P&P
SCAN-X BASE ANTENNA $48+$8 P&P

Interstate Dealers:
WA: (09) 387 4966
NSW: (02) 211 0531
QLD: (07) 397 0808
SA: (08) 269 4744

GFS Electronic Imports
15 McKeon Road
Mitcham, 3132 Vic
TLX 38053 GFS
(03) 873 3939

Concluding our series

How to program in machine language

This fourth and final article in our series on programming the DREAM 6800 in machine language describes techniques for communicating with computers, looks at problems posed by power failures and details assembly language formats. The highlight is a high-resolution graphics routine for the DREAM 6800.

by TONY HAIG

In the previous three articles we have dealt only with the MC6800 microprocessor (MPU) chip and its machine language. However any processor, no matter how powerful, is useless unless it can communicate with external apparatus (or "peripherals"). Usually communication is two-way, receiving information from human-operated switches, other computers or external memory devices (discs, cassettes, punch cards, etc), processing it and then displaying or storing it for further computation. Since every computer needs to communicate with its surroundings a number of devices have been produced for this purpose, and in the first part of this article we'll look at some devices frequently used with the MC6800.

Microprocessor Input/Output

The two most common methods of communicating with a computer's surroundings are via DMA (Direct Memory Addressing) or to use an "I/O (Input/Output) Port". DMA requires the peripheral device to read or write information in the microprocessor's memory, having first disabled the MPU so it cannot make conflicting requests to the memory. While this system is very efficient for large scale or high speed data transfers it has many associated problems – most significantly that such a system usually needs many buffers and counters.

The main alternative to DMA is to utilise an I/O Port such as that shown in Fig. 1. As far as the MC6800 is concerned the I/O Port is just like a memory location, which can be read or written into using normal instructions. The signals READ and WRITE are derived from the MPU's address bus and control signals in such a way that the voltage at READ drops when memory location $8000 is being read. This causes the Tristate buffer to respond by effectively connecting the switches to the data bus. Similarly the WRITE pin goes high when the memory location $8000 is being written to, which causes the latches to be set according to the byte of data just written. Using this simple system the MPU could be programmed to read in an eight-bit piece of data from the switches, process it, then display an eight-bit result on the LEDs. Although this might not seem very exciting or elegant, this method of inputting from Tristate buffers, and outputting to a set of latches is frequently used. Of course the peripherals used by such a port are not limited only switches and LEDs. It can drive transistors switching relays, run printers, talk to other MPUs etc.

Also note that the selection of the address $8000 is purely arbitrary. Any address may be used, provided there is not already a memory device assigned to that location. This simple circuit is the basis for the MC6821 PIA (Peripheral Interface Adapter) which is quite a complicated, but very flexible device. It contains the circuitry for two "bidirectional" eight-bit ports plus four extra control pins which may be used to interrupt the MPU (See Fig. 2). The term "bidirectional" means that the port can be programmed to output data at one stage in the program then later be used to input data, or even accept input data on some bits and output data on others. This is achieved by storing appropriate values in the internal Data Direction Register (DDR): each binary one in the DDR indicates that that bit is being used for output; a binary zero specifies input.

For example FF=11111111 stored in the DDR will be interpreted as all bits used for output, 00 means all bits are used for input and C9 = 11001001 means that bits 7, 6, 3 and 0 are being used to output while the others are used to input. A second register, the Peripheral Register (PR), is used to store the actual values being input or output. Each port also has a Control Register, which performs two main tasks:

Firstly it controls whether the DDR or PR can be accessed – the two Control Registers are set up to "look" like memory locations – in the DREAM Control Register A looks like a piece of RAM at $8011 (Control Register B is at $8013), so an instruction like LDAA $8011 will store the accumulator in Control Register A. However the DDR and PR must be set up differently. Both occupy the same memory address, so when the 6821 gets a command to access this address (in the DREAM $8010 for Port A, $8012 for Port B) it checks bit 2 of the appropriate control register. If that bit is a one then the PR is accessed, otherwise it accesses the DDR. This may seem a little clumsy – it is – however the 6821 is built this way so that if desired the two ports could be wired up as a single 16 bit port. Also the DDR is usually not frequently accessed, often it is initialised at power-up, then bit 2 is permanently set and the PR can be merrily accessed without worrying about bit 2.

The second function of the Control Registers is the maintenance of the four control lines, labelled CA1, CA2, CB1, CB2. CA1 and CB1 can be only used as inputs although CA2 and CB2 can be us-

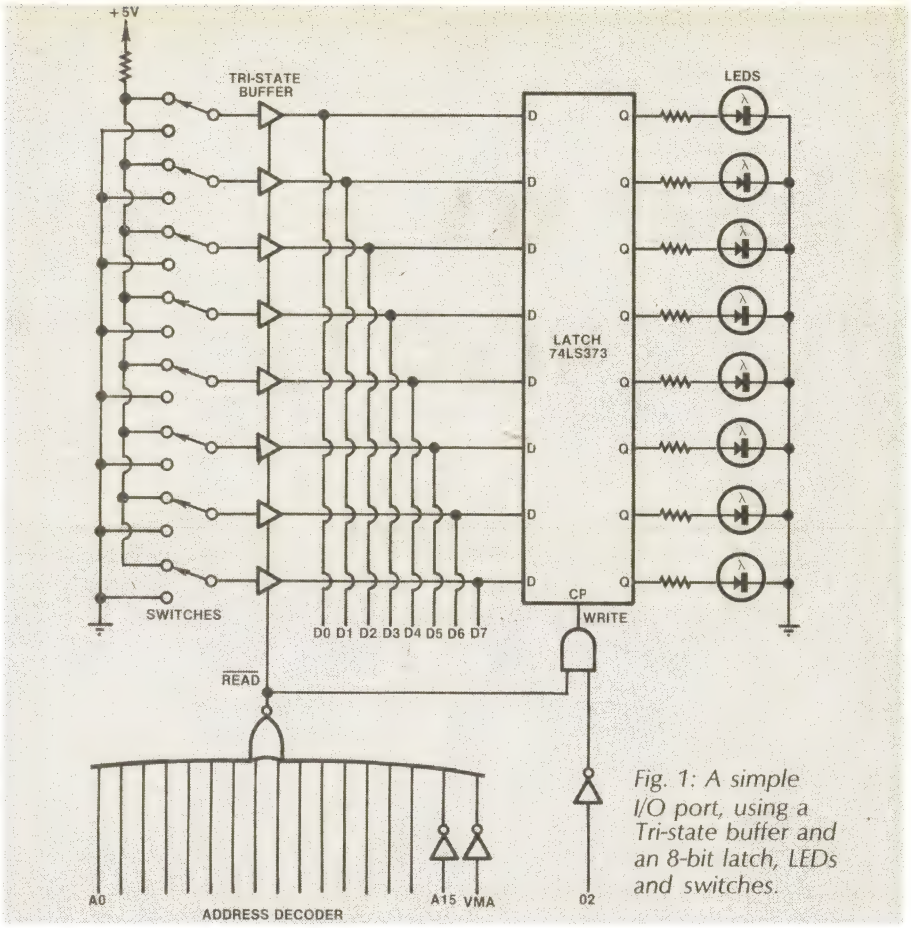


Fig. 1: A simple I/O port, using a Tri-state buffer and an 8-bit latch, LEDs and switches.

ed as either inputs or outputs. When bit 1 of CRA is "1" the transition of the voltage at CA1 from low to high has the effect of setting bit 7 of CRA if not already set. Similarly if bit 1 is "0" then it is the transition of CA1 from high to low voltage which sets bit 7. The only way bit 7 can be set is by the selected transition of the voltage at CA1. If you try to write a "1" into this bit it will be ignored. The only way to reset this bit is to read from the PRA or DDRA. If bit 0 of the CRA is set then whenever bit 7 is high the pin IRQA goes low. This pin is usually connected to the MPU interrupt pin. CA2 can be set to operate as either an input or output depending on bit 5 of CRA. When bit 5 is zero then CA2 acts the same way as CA1 except it uses bits 6, 4 and 3 instead of bits 7, 1 and 0. When bit 5 is "1" CA2 acts as an output, if bit 4 is "1" then it outputs bit 3 of CRA. However if bits 3 and 4 are "0" the CA2 outputs a "1" when bit 7 is a "1". It then returns to "0" when the MPU reads (writes) PRA or DDRA. Finally if bit 4 is a "0" and bit 3 a "1" the CA2 is always "1" except after a read (write) operation on PRA when it briefly drops to "0". Thus if CRA has 25 = 00100101 stored in it, this is interpreted as setting CRA2 as an output and outputting whatever bit 7 is (initially "0"). CRA1 may interrupt the MPU on a high to low transition, and PRA is accessible (not DDRA).

Control Register B operates in the same way to maintain control lines CB1 and CB2.

Probably after reading all that you're scratching your head wondering why anyone in their right mind would want low pulses and funny bit 7s and so forth. To answer this let's look at the specific application of interfacing a MC6800 to a printer. The printer accepts 8-bit ASCII characters to be printed every time the STROBE signal goes from low to high. In return it creates the signals OUTP and OUTR which go low when the printer runs out of paper or ribbon; ERR indicates it has just been given a bad character or that OUTP or OUTR is low, BSY indicated that the printer is currently printing, so will not accept any more characters, and SEL is low if the printer is plugged and switched on. It also requires a RESET signal which must be provided to initialise it after power-up and to clear any error condition.

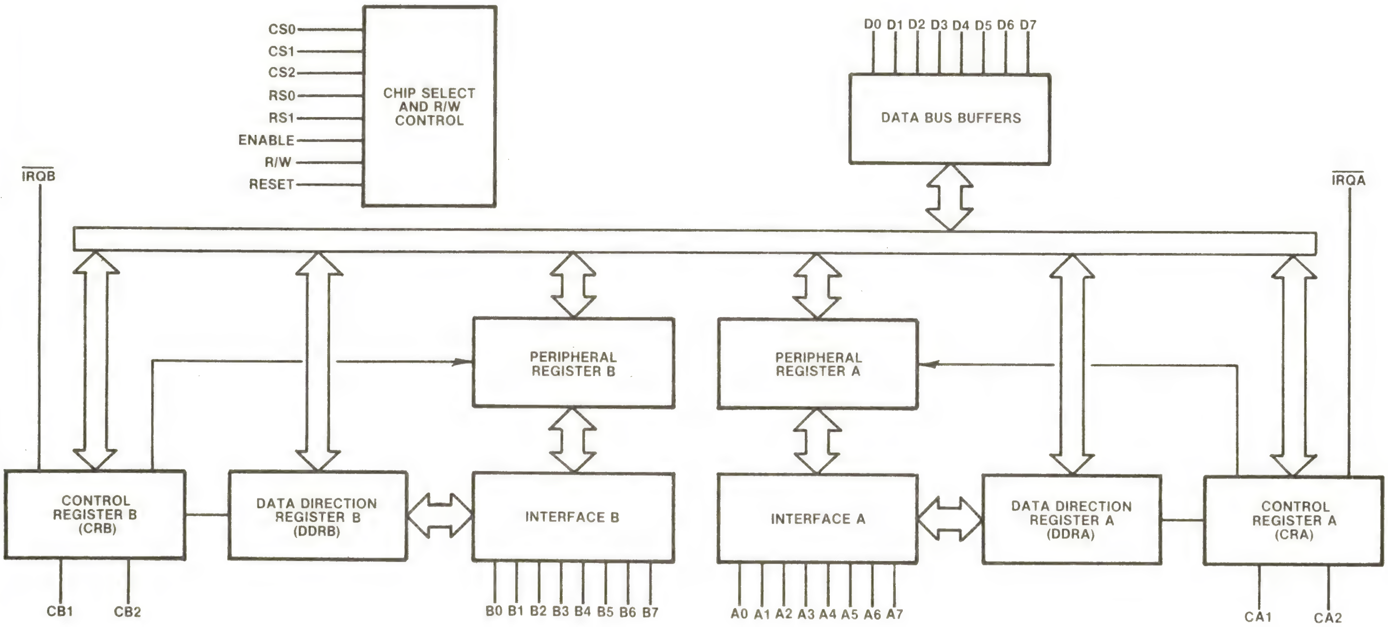


Fig. 2: The MC6821 Peripheral Interface Adapter, a versatile device for microprocessor Input/Output applications.

6800 programming

One possible way to set up this system is shown in Fig. 3 while Fig. 4 gives some program fragments which could be used to initialise, print and handle errors. Note how many things the 6821 will do automatically. It will provide the STROBE automatically whenever a new data character is put into Port B. It will automatically provide the RESET pulse each time an error occurs, and RESET can also be provided at the beginning. Bit 7 will be automatically cleared when the status is read in from Port A, which also returns the RESET line to high. All in all the device makes programming input/output much easier and quicker at the critical times, although the startup procedure takes a little doing. It's worth noting that the slight differences between Port A and Port B make Port A a better choice as an input port and Port B a better output port, although, of course, either port is capable of handling input or output.

This philosophy is extended to the output buffers of the PIA: all Port B output buffers are slightly higher-powered and are Tristate when acting as inputs (eg, absorb negligible power). Port A buffers all have 5kΩ pullup resistors to keep the inputs high if nothing is connected or if the connection is somehow broken.

The program in Fig. 4 assumes that the PIA involved is at $8020, that the MPU has a DREAM-like interrupt vector at $0000 and that ERR is not the only signal capable of interrupting the MPU at any given time. This is in fact generally the case; in the DREAM for example, the ERR may have to compete with the 20ms "heartbeat" and possibly an interrupt driven keypad. This is the reason that bits 6 and 7 of each CR are so important since it contains a record of which control line is actually requesting the interrupt. When interrupted, the MPU should read the control registers of the various PIAs, work out which line(s) are requesting an interrupt and then process them. It is also important to note that when interrupted by a PIA, the interrupt flag must be reset by performing a read on the appropriate PR, even if it is not required, before the RTI instruction, otherwise the PIA will continue to interrupt the MPU until it is cleared.

The process of polling the PIA(s) mentioned above (and in the third article) is reasonably efficient when only a couple of devices are capable of interrupting the MPU. If many ports were capable of interrupting the MPU then polling becomes a little inefficient. This can be overcome by an interesting device manufactured by Motorola. The MC6828 PIC (Priority Interrupt Controller) is connected to the MPUs A4-A1 address lines, as in Fig 5. Up to eight interrupt signals

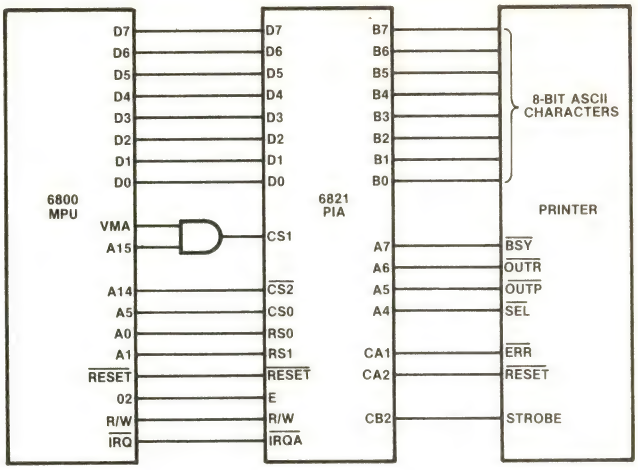
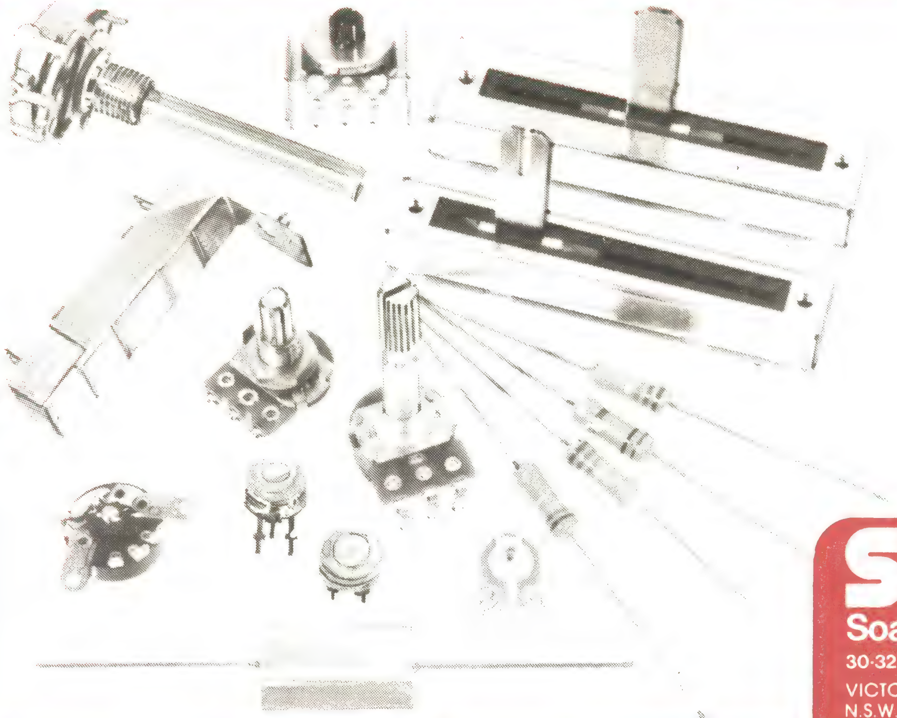


Fig. 3: right, interfacing a 6800 MPU to a parallel printer, using a PIA.

Fig. 4: Below, a program to drive the printer.

```
THIS SECTION INITIALISES THE PIA AND PRINTER:

0200  LDX   $8020   CE8020    Using indexed addressing saves 8 bytes
0203  CLR   01,X    6F01      Select DDRA
0205  CLR   00,X    6F00      Reset all DDRA bits (all inputs)
0207  LDAA  #34     8634      Select PRA, and output a low on CA2
0209  STAA  01,X    9701
020B  LDAA  00,X    9600 ←┐   Input the status of printer
020D  BITA  #10     8510  │   If the printer has not been switched on
020F  BNE   FA      26FA ─┘   then loop until it is.
0211  LDAA  #25     8625      Select PRA, output a low on CA2
0213  STAA  01,X    9701      unless bit 7 is set, set bit 7 if CA1 goes
0215  CLR   03,X    6F03      from "1" to "0"
0217  LDAA  #FF     86FF      Select DDRB
0219  STAA  02,X    9702      Set all DDRB bits (all outputs)
021B  LDAA  #2C     862C
021D  STAA  03,X    9703      Select PRB, Disable CB1, CB2 pulses
021F  LDX   #0340   CE0340    low after writing into PRB
0221  STX   $00     DF00      Save the address of the printer error
0224                          routine in the DREAM interrupt vector
0226                          CONTINUE WITH MAIN PROGRAM

THIS SECTION PRINTS THE CHARACTER IN ACCA:

0300  LDAB  $8020   F68020←┐  Loads status of printer
0303  BPL   FB      2AFB  ─┘  If bit 7 is not set (eg printer busy) loops
0305  STAA  $8022   B68022    until the printer is free
0308                          Then it writes Acc A, CB2 will be
                              automatically pulsed for 1μs

THIS IS THE INTERRUPT ROUTINE:

0340  LDAA  $8021   F68021    First checks if bit 7 of CRA is set
0343  BPL   XX      2AXX──→   If not then branch to rest of interrupt
0345  LDAA  $8020   F68020    routine
0348  BITA  #40     8540      This clears bit 7 automatically
034A  BEQ   1A      271A ──┐  If bit 6 is set then end of ribbon
034C  BITA  #20     8520   │
034E  BEQ   38      2738 ──┼┐ If bit 5 is set then end of paper
0350                       ││
                           ││ Otherwise the printer has received a
                           ││ dud character. This section should tell
                           ││ the user about the data error
       RTI          3B     ││ Return from Interrupt
                           ││
                           ││ This bit should tell the user he has run
0360                    ←──┘│ out of paper
       RTI          3B      │ Return from Interrupt
                            │
                            │ This bit should tell the user to replace
0380                    ←───┘ the ribbon
       RTI          3B        Return from Interrupt
```

SOANAR RESISTORS



Fixed

- Carbon Film
- Metal Film
- Flame Proof
- Power
- Wire Wound

Variable

- Potentiometers
- Slide
- Rotary
- Trim
- Cermet
- Switched
- Ganged

Rheostats

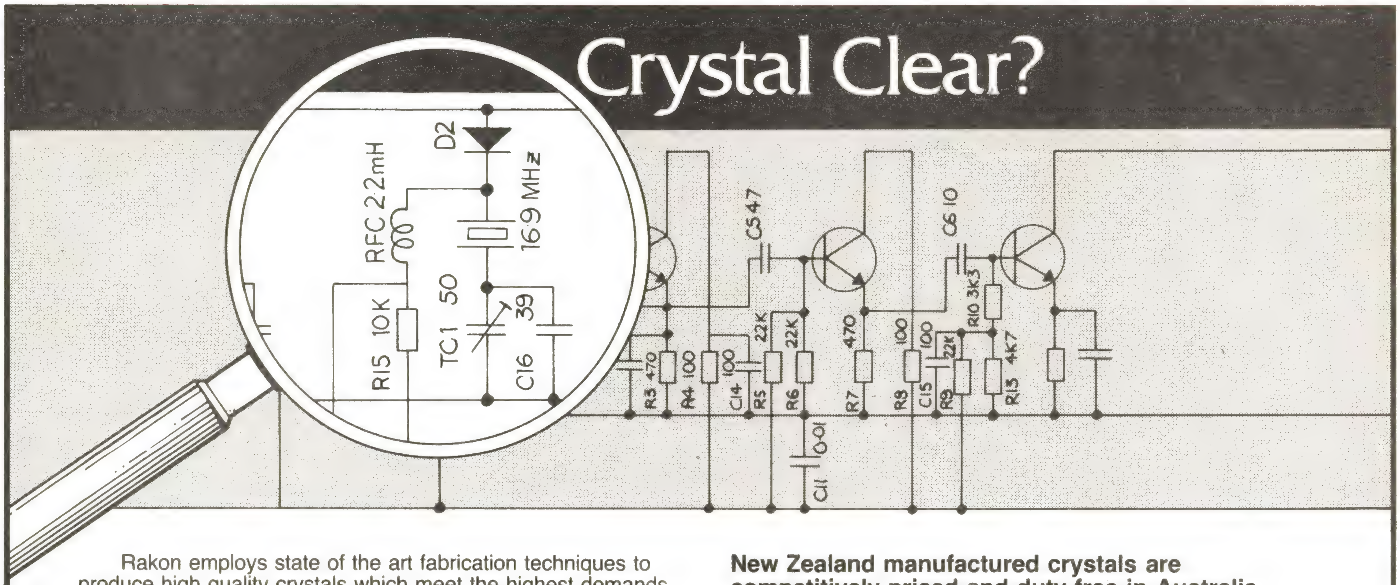
SOANAR

Soanar Electronics Pty Ltd

30-32 Lexton Road, Box Hill, Vic., 3128, Australia.

VICTORIA: 840 1222
N.S.W. 789 6733
STH. AUST: 42 8918
QUEENSLAND: 52 1131
WEST. AUST. 381 9522
TASMANIA: 31 6533

Crystal Clear?



Rakon employs state of the art fabrication techniques to produce high quality crystals which meet the highest demands of modern communications and frequency control technology.

Supplied in a welded, hermetically sealed package, Rakon crystals are capable of operating within such limits as ± 5 parts per million over a temperature range of –10 to +60 degrees celsius, with low ageing characteristics.

Where the crystal parameters are unknown, our experienced engineering staff is available to advise on selection of the correct specification.

Standard Microprocessor Frequencies

Rakon also offers a quality range of low costs crystals specially designed for microprocessor applications.

New Zealand manufactured crystals are competitively priced and duty-free in Australia.

Inquiries concerning price and delivery should be forwarded to:

RAKON INDUSTRIES

9 George Street, Mt. Eden.
P.O. Box 9308, Newmarket, Auckland.
Cables: "RAKON". Telex: 21682.
Phone (64-9) 605-010, 605-270.

Civil Aviation Department Approval No. AWB556

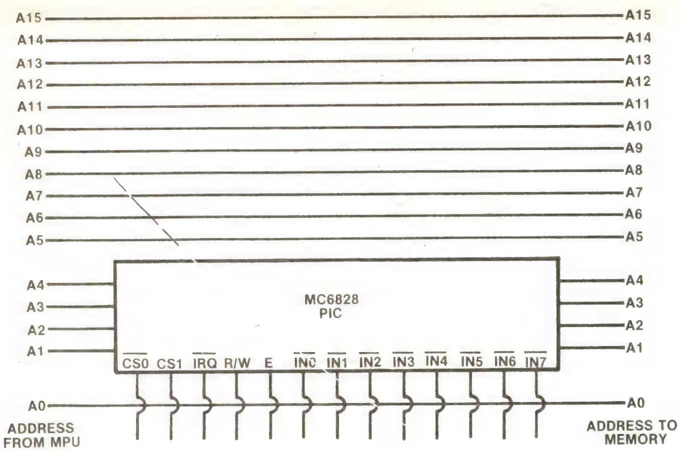


Fig. 5: The MC 6828 Priority Interrupt Controller circuit.

are input to lines IN0 to IN7. This device then interrupts the MPU, which promptly stacks away its registers and tries to read the address of its interrupt vector from memory locations $FFF8 and $FFF9. This is detected by the MC6828 which up to then has been passing on Address lines unmodified. It now alters the address lines so that in fact the MPU reads one of the eight 16 bit addresses in the range of $FFE8 to $FFF7, as in Fig. 6a.

ADDRESS OF INTERRUPT VECTOR	PIN	PRIORITY
FFF6 and FFF7	IN7	Highest 7
FFF4 and FFF5	IN6	6
FFF2 and FFF3	IN5	5
FFF0 and FFF1	IN4	4
FFEE and FFEF	IN3	3
FFEC and FFED	IN2	2
FFEA and FFEB	IN1	1
FFE8 and FFE9	IN0	Lowest 0

Fig. 6a: MC6828 Address Vectors

ATTEMPTING A WRITE TO THIS ADDRESS:	DISABLES UP TO AND INCLUDING
FFE0 or FFE1	All enabled
FFE2 or FFE3	IN0
FFE4 or FFE5	IN1
FFE6 or FFE7	IN2
FFE8 or FFE9	IN3
FFEA or FFEB	IN4
FFEC or FFED	IN5
FFFE or FFEF	IN6
FFF0 or FFFF	All disabled

Fig. 6b: Interrupt Mask

This means the MPU "thinks" that there is only one device capable of interrupting it and the address for its interrupt routine is at $FFF8, but effectively the system has up to eight independent interrupts, each with their own interrupt routine, the address of which is stored in the address table at $FFE8-$FFF7. The MC6828 also determines priority if more than one interrupt takes place simultaneously – IN7 is the highest, IN0 is the lowest priority. Furthermore if the MPU writes any data to the memory locations $FFE0-$FFFF (which must be ROM), then the MC6828 interprets this as an order to disable some of the interrupts, as given in Fig. 6b.

While on the subject of support devices for the MC6800, although there are many produced to facilitate various operations I might just briefly mention three of them.

The MC6820 PIA is an old version of the MC6821. It is operationally identical to the MC6821, but some of the timing is marginally slower. In nearly all systems a 6820 may be substituted for a 6821 (including the DREAM).

The 6850 ACIA (Asynchronous Communications Adapter) is another example of an I/O Port. However unlike the PIA its output is converted to a stream of asynchronous serial data. It has four internal registers; Input Data, Output Data, Control and Status. Both Input and Output Registers are buffers to a second pair of registers which are actually being used to create or assemble data, so the MPU is free to change these registers while the next byte is being read and the last byte is being written.

The MC6850 Modern (Modulator-Demodulator) can be connected to the MC6850 to convert the serial data to FSK (Frequency Shift Keying) format suitable for transmission via standard telephone lines. It also provides the conversion back from FSK to serial data and some elementary phone ringing signals.

Power Failures

There is nothing quite like having patiently keyed in a lengthy program, to any computer, and then have it destroyed by an almost imperceptible power flicker (and surely there is a corollary to Murphy's Law which links the occurrence of power failures to program length?)

One solution is to put an enormous battery across the unregulated DC power supply to drive the computer during such powerdowns. However the logistics of supplying 20-30W for any period of time becomes quite bulky, so we look for better solutions. The 2114 MOS RAMs used in the DREAM will retain their data if voltage is as low as 1.5V, and at these voltages they consume only 100mW each. This is very high compared to CMOS RAMs which consume something like 100μW, but we can provide a few hundred milliwatts for a reasonable period of time from a couple of drycells or nicads. Maintaining power to the RAMs (and thus keeping the data) but forcing the rest of the computer to shut down is a reasonable solution.

When the power fails it does not vanish immediately, but because of the power filter capacitors takes at least a few milliseconds to drop to an unusable value. To us that is not much time, but in this time the microprocessor can execute thousands of instructions to either prevent loss of power or to shutdown the system "gracefully", so that no data is lost, and when the power returns the program can be continued. In shutting down gracefully the computer must save in RAM all internal registers and all I/O Port registers, then when the power is returned the MPU must restore all internal and I/O Port values and continue with the program as if nothing had happened.

Fig. 7 shows a suitable circuit for detecting a power failure. When running normally the unregulated power supply Vcc is fairly constant, in the range 17-25 volts (depending on the transformer, mains voltage, load, etc). V_a will be constant at 3.3V and V_b will be set by the trimpot-divider network to a voltage just over this so the op amp output will be +ve saturation and the signal PowerFail will be more than 3V. As the power drops, V_a remains constant at 3.3V and V_b will drop below 3.3V at some critical voltage V_{crit} determined by the trimpot setting.

This causes the output to drop to negative saturation and PowerFail to drop to less than 0.6V. The 220kΩ

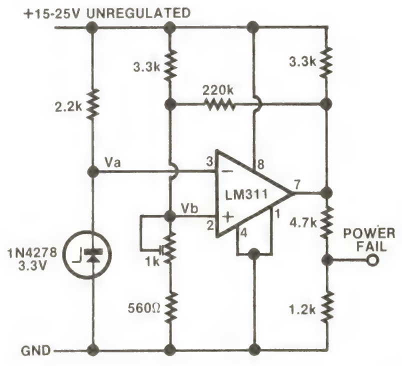


Fig. 7: Power failure detection circuit.

THE COMPUTER COUNTRY GROUP

The Apple Professionals

apple computer
® Authorized Dealer

WE ARE VICTORIA'S OLDEST APPLE DEALER

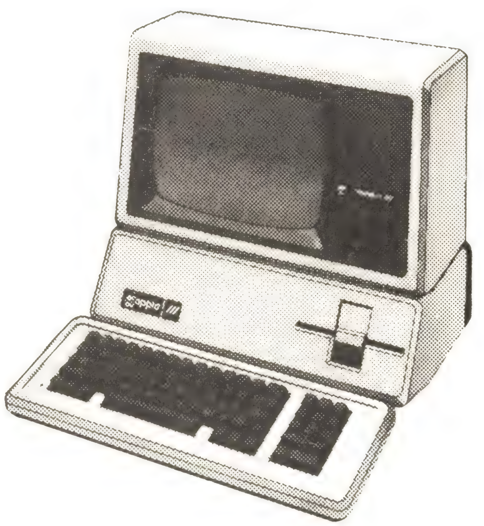
EXCELLENT PRICES!
EXCELLENT SERVICE!
EXCELLENT BACKUP!
WHY GO ELSEWHERE?

WE HAVE PROBABLY ONE OF THE BIGGEST RANGES OF APPLE PRODUCTS IN AUSTRALIA

COMPUTER COUNTRY (VICTORIA) PTY LTD
338 QUEEN STREET, MELBOURNE,
VIC 3000. (03) 329 7533

IN QUEENSLAND CALL
COMPUTER CITY
600 OLD CLEVELAND ROAD,
CAMP HILL, QLD 4152. (07) 398 6759

IN SOUTH AUSTRALIA CALL
KEY COMPUTER
1055 SOUTH ROAD, EDWARDSTOWN,
SA 5039. (08) 277 8936



IN WESTERN AUSTRALIA
COMPUTER CHOICE
1297 HAY STREET, WEST PERTH,
WA 6005. (09) 332 5651

SOON TO BE OPENING IN WOLLONGONG, NSW; AND TASMANIA resistor accentuates the dropping, causing it to "snap" low. The trimpot is set so that V_{crit} is as high as possible without false triggering.

When the power is returned the above procedure is reversed with the 220kΩ resistor providing some hysteresis so that if the power should just dip low enough to trigger the circuit (a "brown out") the computer will have sufficient time to completely shut-down before prematurely being told to start-up again. The PowerFail signal is suitable for use with logic gates or to be connected to the non-maskable interrupt of the MPU. (Editor's note: The CA 3140 should also work in this circuit.)

When interrupted the MPU will automatically push all internal registers onto the stack (except the Stack pointer of course) so this does half the work for us. All the power failure routine has to do is store all I/O Port registers in RAM. The easiest way is to read them in and push them onto the Stack. Finally the Stack pointer has to be saved at some RAM location. When the power returns the system will automatically perform a reset, so the reset routine should either realise this and return the computer to its original set-up ("warm start") or should completely reinitialise the system if the computer has just been switched on ("cold start"). This is sometimes impractical, such as in the DREAM where it would require significant rewriting of the EPROM.

Another solution is to have the MPU interrupted again by the signal PowerFail returning to high voltage. This means that it will try to reinitialise the system from the reset routine but will not get very far before being grabbed by the NMI, a NMI power-up routine can then reinstate the previous conditions. This set up is quite workable, but has two points worth noting — firstly, the RAM must be disabled prior to the NMI signal during a warmstart, otherwise the reset routine will start mucking up the carefully preserved RAM; secondly, during a coldstart the NMI should remain high and the RAM should be fully enabled to allow the reset routine to work correctly. Note that on all systems the RAM must be disabled by holding the CE high (eg between 5V and the RAM supply voltage) while the power is below normal. This is done for two reasons — firstly to guarantee the data is held by the RAM at the subnormal voltage — secondly as the MPU fails it may send out erroneous write signals that could corrupt the RAM.

Assembly Language

In the first article in this series it was pointed out that the series of hexadecimal numbers used by the MPU and interpreted as program instructions are fairly meaningless to human programmers. So we introduced mnemonics, and programming became the writing of a list of mnemonics and operands which was converted (assembled) into a string of hexadecimal digits just before entry. The program fragments and samples presented so far have been given in a form suitable for this mode of program writing. There are some problems with this system which surface rapidly.

Firstly the actual task of converting the listing into machine code is a tedious business. And once assembled, if you suddenly need to insert even one extra byte (at the debugging stage this may be frequent) whole sections of code must be meticulously adjusted. Thirdly, any sort of moving around of subroutines or chunks of code is very messy and time-consuming and lastly it is not always precisely clear where the various references are pointing to. On small machines there is little that can be done about this, besides utilising the Index and relative branching to make the program relocatable with minimum need for alteration.

However on larger machines it becomes possible to get the computer itself to do the work for you by providing it with your set of mnemonics which it then assembles into machine code (usually referred to as "object code"). The mnemonics can then be edited, altered or saved as necessary as the program is gradually debugged or rewritten. After each set of alterations the computer can be told to completely reassemble the program and thus create new object code.

In order to use assembly language you must have an Editor program to create and modify the "source" listing, and an Assembler program which then can take the source code and convert it into object code which may be placed directly into memory or printed out. Note that these programs need not be run on the machine that the object code is destined for. Professional microprocessor programmers often write their programs in assembly language on a large machine, and then transfer the object code to the microprocessor either by keying in the data by linking the two machines, or by plugging in a new EPROM created by the large computer.

Generally assembly language consists of a set of instructions, each occupying one line of source program. Each line is broken into four columns or "fields", called the Label, Mnemonic, Operand and Comment fields. See Fig. 8 for a sample of Assembly Language.

The second column is the mnemonic field which must always contain the mnemonic of the instruction represented by each particular line. The first column is the label field. If there is anything in this field it is treated as a name which refers to the address which that particular line is eventually assembled to. So if the instruction with the label COUNT is assembled to memory location 0216 it is interpreted as STAA $0216. Similarly when the assembler reaches the instruction BNE LOOP it will compute the offset required to branch to location LOOP and substitute this number, for the label.

The third column is the operand field which may be empty if the operation does not require an operand. If more than one operand is needed then each operand is separated by a comma. The operands may be labels numbers, expressions (eg, 27 x 8, or MULT + 9/2) or registers. Most assemblers allow for flexi-

```
LABEL     MNEMONIC  OPERAND              COMMENT
; This subroutine multiplies the two accumulators together

           ORG       $0200H     ;Subroutine is located at 0200
NINE       EQU       9          ;Define initial value of count
MULTIPLY   STAA      $MULT      ;Save multiplicand
           LDAA      #NINE      ;Initialise count
           STAA      $COUNT
           CLRA                 ;Clear A and C
LOOP       BCC       MPY        ;If the carry is set
           ADDA      $MULT      ;Then add the multiplicand to acc A
MPY        RORA                 ;Rotate C,A,B right
           RORB
           DEC       $COUNT     ;Decrement count
           BNE       LOOP       ;Repeat until count =0
           RTS                  ;Return from subroutine
COUNT      DATAB     0          ;Reserve space for count
MULT       RES       1          ;Reserve space for multiplicand
           END
```

Fig. 8: A subroutine to multiply the accumulators with the 16-bit result ending up in A and B.

ble use of different bases in expressions and constants, with hexadecimal numbers suffixed by a H, decimal numbers suffixed by T or unsuffixed, octal numbers suffixed by a Q, and binary by a B. So the expression 44H + 67Q + 10 + 10101B is interpreted as $44_{16} + 67_8 + 10_{10} + 10101_2$ (= 154_{10}).

The fourth field is the comment field which may be empty or may contain a comment explaining what is actually happening. The comment is preceded by a semicolon and is ignored by the assembler but is useful as an explanation to the human programmer. It is also legal for the comment to begin at the start of a line (as in Fig. 8) or to be preceded by blanks.

In the mnemonic field you will (perhaps) have noticed five unfamiliar mnemonics – ORG, EQU, DATAB, RES and END. These are not in fact machine language operations but are "pseudo-operations", which are commands to the assembler which do not necessarily generate object code.

ORG (Originate) is such a command. It tells the assembler that the first byte of the object code is to be at the location specified by the operand. Without such an ORG command the assembler would not know where the object code is to be assembled (most would assume that it is to be assembled at $0000). The source program may include any number of ORG statements, each causing the object code to begin being assembled at the new location.

The EQU (Equate) command must have a label and an operand. It tells the assembler that instead of the label referring to a memory address it instead refers to the operand. In Fig. 8 I gave the rather trivial example of making the label NINE equal to 9. Thus the statement LDA #NINE is interpreted as LDA #09.

The DATAB statement tells the assembler to set that byte of object code to the value of the operand, which must therefore be a number in the range 00 – FF. As the name implies it is useful for generation of data or to specify memory locations to be used as variables. Similar statements implemented on most assemblers are DATAW, which creates two bytes equal to the value of the operand which is in the range 0000 – FFFF, and DATAM which has a string of characters as its operand. It creates a set of object code bytes equal to the ASCII (or whatever character code is used by that assembler) value for each character (eg DATAM "This is a string" would generate the ASCII object code 54686973206973204120737472696E67). The DATAB statement is particularly fond of changing its name; it also gets called DEFB, BYTE, DFB, FDB and probably others.

```
;This is an example of “higher resolution”
;graphics on the DREAM 6800
PIA    EQU    8012H        ;SET ADDRESS OF PORT B OF PIA
INCR   EQU    8            ;EACH FRAME COUNT IS INCREASED BY ±
                           INCR
UPPER  EQU    02BFH        ;MINIMUM DELAY FOR TOP OF FRAME
       ORG    0080H
COUNT  DATAW  0            ;THIS IS THE CURRENT VALUE OF DELAY * 8μs
PLUS   DATAW  0            ;INCREASE PER FRAME OF COUNT
       ORG    0200H
START  JSR    $C079        ;THIS IS A CALL TO THE CHIPOS ROUTINE TO
                           CLEAR SCREEN
       LDX    #INTERR      ;STORE THE NEW INTERRUPT VECTOR AT
                           0000
       STX    $0
       LDX    #UPPER       ;INITIALISE COUNT
       STX    $COUNT
RESET  LDX    #INCR        ;AT TOP AND GOING DOWN, SO PLUS
       STX    $PLUS        ;EQUALS INCR
WAIT   WAI                 ;WAIT FOR INTERRUPT TO HAPPEN
       LDAA   $COUNT+1     ;THIS IS A 16-BIT ADDITION OF COUNT +
                           PLUS
       ADDA   $PLUS+1      ;WITH THE RESULT GOING INTO COUNT
       STAA   $COUNT+L
       LDAA   $COUNT
       ADCA   $PLUS
       STAA   $COUNT
       LDX    $COUNT
       CPX    #UPPER       ;ARE WE AT THE TOP
       BEQ    RESET        ;YES – THEN REINITIALISE PLUS
       CPX    #UPPER+4000H ;ARE WE AT THE BOTTOM
       BNE    WAIT         ;NO – THEN GO AND WAIT FOR AN
                           INTERRUPT
       LDX    #–INCR       ;ELSE AT BOTTOM AND GOING UP, SO PLUS
       STX    $PLUS        ;EQUALS –INCR (FFF8)
       BRA    WAIT         ;KEEP LOOPING
;This is the interrupt routine:
INTERR LDAA   $PIA         ;THIS IS A DUMMY READ TO CLEAR BIT 7
       LDAA   #36          ;TURN OFF SCREEN BY SETTING CB2 LOW
       STAA   $PIA +1
       LDX    $COUNT       ;THIS LOOP DELAYS THE COMPUTER BY
LOOP   DEX                 ;COUNT * 8μs
       BNE    LOOP
       LDAA   #3F          ;RETURN SCREEN TO NORMAL
       STAA   $PIA +1
       NOP                 ;THIS OP-CODE WILL APPEAR ON SCREEN
       RTI                 ;END OF INTERRUPT ROUTINE
       END    START        ;END OF PROGRAM
```

Fig. 9: Source listing for higher resolution program.

RES (Reserve) is another variously named operation. It orders the assembler to leave a whole block of memory, usually for use as a large data storage area. The example of RES 1 is a rather trivial example of this as a DATAB command could have been used equally well, but clearly RES 200 is much better than writing two hundred DATAB instructions.

END tells the assembler that it has reached the end of the source listing. If it has an operand this is remembered by the assembler as the starting location of the program it has just compiled.

Two other very useful pseudo-ops are MACRO and ENDM. Recall that when sequences of instructions were repeated exactly within a program the program length could be reduced by putting the repeated section into a subroutine and then using JSR or BSR instructions to call it. Macros are the reverse of this, they are a group of operations which are defined for the assembler as follows:

```
Label MACRO     parameters . . .

                these are normal
                machine language in-
                structions

          ENDM
```

When the assembler comes to a MACRO it checks the syntax, notes the name and number of operands, then ignores it, generating no object code at that stage. However each time it finds the label of the MACRO in the mnemonic field with the correct number of operands it treats it as a legal operation, whose object code (instead of being 1, 2, or 3 bytes long in the case of normal machine language instructions)

Mr Howard increases sales tax by 2%.

How does this affect your company's profits?

15 seconds to answer.

You're probably solving this sort of problem by pulling out an analysis pad and drawing up a spreadsheet by hand – taking your budget and recalculating every value in a series of columns – then checking them. If you're lucky you have a programmable calculator to help.

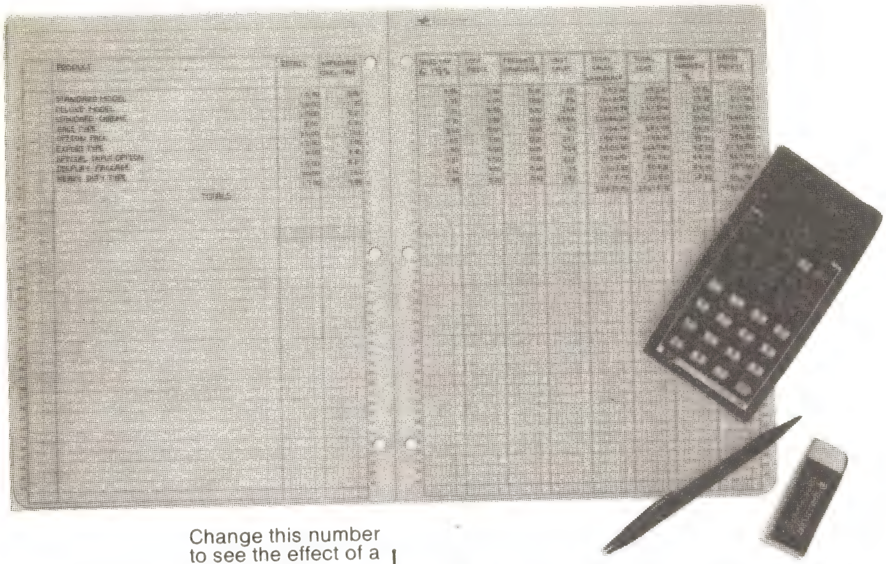
Here's what you should be doing: Multiplan running on a personal computer replaces pencils, paper, erasers, calculators and endless manhours in modelling, estimating and planning activities. Like the example here: if your sales tax rate is 17.5%, you simply put that figure at the top of the sales tax column – Multiplan calculates each product's sales tax value. If a price changes or the tax rate changes, you change one number –Multiplan changes the rest. You see all the results on a spreadsheet 63 columns wide, 255 rows deep and pages thick.

Multiplan is a computer program for non-computer people. Multiplan lets you assign names to cells or areas such as 'sales' or 'expenses', then lets you refer to that name in future formulas. On Multiplan you can have a formula like:
Profit = Sales − Expenses
On other spreadsheet programs that would look more like:
Profit = R1C3 − R5C12
Multiplan is also the only spreadsheet program capable of colour operation and there are none of the problems with forward reference handling that can cause other programs to give completely spurious answers. Multiplan lets you access data on other spreadsheets and allows multiple windows on the screen so you can see the effects of new entries on other parts of the sheet.

A friendly system. Multiplan is specifically designed to eliminate the routine and tedious tasks associated with forecasting, modelling and planning. In designing the program, Microsoft, the world's largest producers of personal computer software, aimed to provide users with an easy-to-use tool which maximizes executive thinking time while minimizing the time required to learn and use the system productively.

Multiplan is available right now for use on Apple™ computers, and will soon be available for use on the Osborne 1™ and standard 8" CP/M™ computers. Versions for other computers are under development.

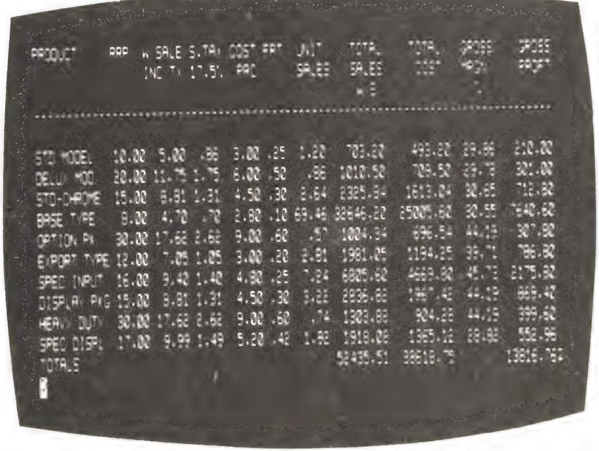
Call into your nearest computer store and see Multiplan in action – your next forecast need only take you 15 seconds instead of hours.



Change this number to see the effect of a sales tax change

Column widths are individually variable

All dependent variables are automatically calculated to your formula



```
PRODUCT      RRP  W SALE S.TAX COST FRT  UNIT   TOTAL     TOTAL   GROSS   GROSS
                  INC TX 17.5%  PRC      SALES  SALES     COST    MRGN    PROFT
                                                W $               %
..............................................................................
STD MODEL   10.00  5.00   .88  3.00 .25  1.20   703.82    493.82  29.86   210.00
DELUX MOD   20.00 11.75  1.75  6.00 .50   .86  1010.50    709.50  29.78   301.00
STD-CHROME  15.00  8.81  1.31  4.50 .30  2.64  2325.84   1613.04  30.65   712.80
BASE TYPE    8.00  4.70   .70  2.80 .10 69.46 32646.22  25005.62  30.55  7640.62
OPTION PK   30.00 17.62  2.62  9.00 .60   .57  1004.34    696.54  44.19   307.80
EXPORT TYPE 12.00  7.05  1.05  3.00 .20  2.81  1981.05   1194.25  39.71   786.80
SPEC INPUT  16.00  9.40  1.40  4.80 .25  7.24  6805.60   4669.80  45.73  2135.80
DISPLAY PKG 15.00  8.81  1.31  4.50 .30  3.22  2836.82   1967.42  44.19   869.40
HEAVY DUTY  30.00 17.62  2.62  9.00 .60   .74  1303.88    904.28  44.19   399.60
SPEC DISPL  17.00  9.99  1.49  5.20 .42  1.92  1918.08   1365.12  28.88   552.96
TOTALS                                        52435.51  38618.75         13816.76
█
```

Simulated screen

Multiplan is expected in stock and the price is correct at time of going to press.

Multiplan

Apple II version: $295 + tax

from MICROSOFT

For the name of your nearest Microsoft dealer or more information on Multiplan contact:
Wiser-Microsoft
PO Box 95, Forestville 2087. Ph (02) 451 9445

Glover & Assoc. WM/6

may be almost any length. The entire macro is assembled with the operands of the calling instruction being substituted for the parameters, which in turn are substituted for operands of instructions within the macro. The net result of this is that the length of the source program is shortened considerably and the program becomes easier to read and understand although it generates precisely the same object code.

However the assembly language programmer must beware. Although in some cases it is the most efficient way to program, often the procedures in macros are better done by calling subroutines, because although the source program may appear to be longer the length of the object program may be much shorter, particularly with long macros, or with few parameters.

Fig. 9 is a small sample program written in Assembly language (with object code in Fig. 10 so you can type it into your DREAM). It provides an example of programming the PIA and using interrupts, thus tying together some of the last few points we looked at. It also shows up the precision timing that can be achieved using machine language programming – there is no way that this program could be written in a high level language; you simply couldn't achieve precise enough timing.

The DREAM's PIA is initially set up by the monitor so that CB2 is high and CB1 has a 300μs pulse every 20ms (a "heartbeat"). When CB2 is high about 5632μs after the heartbeat the MPU will be HALTed and the screen will be displayed, which takes about 8192μs. However if CB2 is low then the computer will not be HALTed and the screen will be disabled until CB2 returns high. If CB2 goes high in the middle of a frame then the MPU will have enough time to start the next instruction before being HALTed and the serial buffer, which was previously disabled, will now have its signals displayed. Thus if the buffer has an 01 in it this will then be displayed as a small dash, as long as a normal dot but only one quarter as high.

It isn't very high resolution graphics, but the dashes can be made into rather nice torpedos or bullets and incorporated into games etc. In this program, however, I have only programmed the computer to make a graphics "dash" move up and down the screen. This is done by waiting for the heartbeat interrupt, turning off the screen, pausing for a few milliseconds then turning the screen back on. To put a dash at the top and middle of the screen we must have the total time from the interrupt to the re-enabling of screen equal to 5650μs. For this to happen the instructions DEX, BNE FD must be executed 703 (2BFhex) times, so when the interrupt routine is called the value 2BF must be loaded into the Index. When it returns from the interrupt routine the computer adds 8 to this value so that when the dash is displayed by the next interrupt it will be 64μs (one line on the TV) lower down.

The computer then waits for the next interrupt. When it reaches the delay number 6BF it is at the bottom of the screen so it will in the future subtract 8 (add FFF8) so the dash will appear to rise. This is implemented by having the ±8 stored at $0082 and the delay number at $0080, and performing a 16-bit addition of the two, each frame (after the interrupt). The commands in the interrupt routine were carefully selected so that the op code of the NOP would be the byte of garbage displayed. If you want to play around with the program try changing the NOP to a RTI, which will give three bufferfuls of "garbage" before the HALT is effected since RTI takes 12μs and the buffer is output every 4μs. Also try changing the LDAA $8012 to LDX $8012 which will still perform the required dummy read but will mean different bytes of garbage are displayed, because the LDX operation takes an extra microsecond to execute.

```
0200          BDC079
0203          CE0232
0206          DF00
0208          CE02BF
020B          DF80
020D          CE0008
0210          DF82
0212          3E
0213          9681
0215          9B83
0217          9781
0219          9680
021B          9982
021D          9780
021F          DE80
0221          8C02B6
0224          27E7
0226          8C06B6
0229          27E7
022B          CEFFF8
022E          DF82
0230          20E0
0232          B68012
0235          8636
0237          B78013
023A          DE80
023C          09
023D          26FD
023F          863F
0241          B78013
0244          01
0245          3B
```

Fig. 10: Object code from Fig. 9.

★ BRIGHT STAR CRYSTALS

Specifications, Dimensions and data sheets available on request

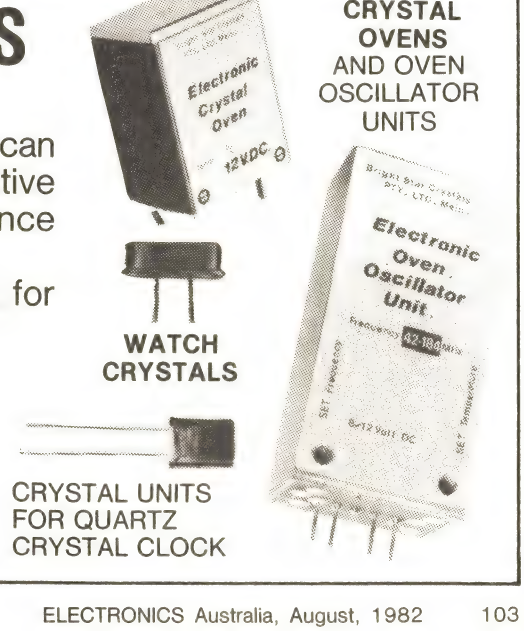
BULK ORDERS: In addition to our normal range we can supply quantity orders (100 up) at very competitive prices. All we ask is 50% of cost with order balance 30 days.

DELIVERY: 5-6 weeks from receipt of Order. Ring for quote: (03) 546 5076. Telex: AA 36004.

NEW NSW AGENT: APP Master Communications, Sydney (02) 682 5044

BRIGHT STAR CRYSTALS

35 EILEEN RD, CLAYTON, VIC
ALL MAIL TO: PO BOX 42, SPRINGVALE 3171



CRYSTAL OVENS AND OVEN OSCILLATOR UNITS

WATCH CRYSTALS

CRYSTAL UNITS FOR QUARTZ CRYSTAL CLOCK

Letters to the editor

Peak power loads key to energy saving

I read with interest your editorial in the April issue of Electronics Australia.

Your statements regarding energy consumption are, of course, perfectly correct, however, in respect to avoidance of power restrictions, energy consumption is, in many ways, not the main factor involved.

One of the most common causes whereby an electricity authority has to implement power restrictions is its inability to meet maximum demands which create "peaks" exceeding the generation capacity.

In such cases if the use of devices with high power ratings could be restricted, supply interruptions or severe restrictions could be minimised.

I would consider it worthwhile to point out to the thousands of readers of your excellent magazine that whilst energy conservation is good for their pockets and helpful in times of power supply shortfalls the judicious reduction of demand at peak periods will assist in maintaining a continuous supply of electricity.

A. E. Dyer, MIE (Aust),
Upper Mt Gravatt,
Queensland.

Slight correction for better bass

I would like to draw your attention to a printing error in my article "Beter Bass For Electronic Organs" (June 1982 issue, page 80). Equation (3) should read

$$V_B = 2V_{AS}Q_T^2/(1-2Q_T^2)$$

Secondly my congratulations on your editorial concerning the Franklin River hydro scheme.

P. J. Hall,
University of Tasmania.

Comment on the Gordon River scheme

As a reader of long standing of your magazine and also an engineer (civil) of the Hydro Electric Commission, I was saddened to see the lack of objectivity expressed in Editorial Viewpoint, June 1982. I suppose we would be less than human if we did not have some emotional blindspots, but the catalogue of insinuations against the proposed power scheme, unrelieved by a single thing in favour, was a little breathtaking.

Were you to give me space, I would be glad to clarify for you the issues on which you clearly lack information. But let me at least remark on some of these.

The $80,000 campaign of which you speak is now "out of the bag": you might be surprised to learn that it does not promote the most favoured scheme at all. What it does is extol the virtues of water as a "fuel" in contrast to oil, gas or coal. In spite of our utilisation of this, our only cheap indigenous fuel, to produce electricity, the per capita use of primary energy of Tasmanians, lags all other Australians.

Contrary to your rhetorical implications, the Gordon below Franklin scheme will generate the cheapest electricity in Australia; and it can be afforded by the consumers because their payments service capital costs and not fuel costs. Your "only . . . 180MW", "enormous capital costs" and similar phrases are irrelevant, and indeed misleading without a standard of comparison.

No one denies the undoubted wilderness value of the area. But coexistence of 99% of the defined SW area with the 1% of the area used by the scheme could hardly be called unreasonable; nor, except in the eyes of the most fanatical, could the creation of a new lake be called "ravaging" the area: the new Lake Pedder, for example, is visited by about 60,000 people a year, and has become one of the biggest scenic attractions of the state. Do none of these facts count?

I am disappointed that you saw fit to enter the debate in such a one-eyed way.

However, your last hope has been realised. The new Government has made the right decision, and the Opposition has agreed with it: the Gordon below Franklin scheme should proceed.

Dr Sergio Giudici,
West Hobart, Tas.

Another timer for long period delays

Re Electronics Australia, June 1982: XR-2243 Timer. I refer to the article by Jeff Skeen and the statement: "Until recently no such integrated circuit existed . . ." This is not true. I have come across the μA2240 in some control equipment and it appears that this IC has been around for some time.

The design of the μA2240 is similar to the XR-2243. It has only eight divider stages but these are brought out individually so that any division from 1 to 256 can be obtained by strapping the respective outputs to the reset line via a limiting resistor.

Not having the data sheet at hand I would say that the supply voltage would have to be higher than 7V as the circuit has an inbuilt zener diode of 7V to supply the counters and control logic.

C. S. Kruger,
Moe, Vic.

MRL Test Tapes distributor — correction

In the June issue of Electronics Australia you stated that Syntec International were the importers of MRL Test Tapes. This statement is incorrect because we have been the exclusive importers of MRL Test Tapes for the last six years.

It would be appreciated that you let your readers know of this correction as soon as possible.

A. K. Norman,
National Marketing Manager
Klarion Enterprises Pty Ltd
PO Box 379, South Melbourne, Vic 3205.

How many corners to the box?

I had proposed building the 12/240V inverter described in your June issue but the technical problems appear insurmountable. I refer to the odd shaped box required to house the project.

In the construction details you specify that it is mounted on six rubber feet, four at each corner and two in the middle. To do this would require either 18 rubber feet or a one cornered box.

I thought at first that it might have been a typographical error but although your typesetters do err at times, I doubt whether they would enter "six" for "18". So the answer must be a one cornered box and these are not available here.

Jim Lawler,
Hobart, Tasmania.

COMMENT: We suggest that you obtain a standard four cornered box and remove the redundant corners. This would leave you with three other corners which could be disposed of to other constructors, perhaps at a handsome profit.

MOSFET MAGNIFICENCE

THE 5000 SERIES AMPLIFIERS FROM ETI HAVE NO EQUAL

POWER AMP. REF: ETI JAN. MAR. 81

"BLACK MONOLITH"

SPECIFICATIONS

POWER OUTPUT	Around 100W RMS into 8 ohms
FREQUENCY RESPONSE	8Hz to 20kHz, +0 – 0,4dB 2,8Hz to 65kHz, +0 – 3dB Note: these figures are determined soley by passive filters
INPUT SENSITIVITY	1V RMS for 100W output
HUM	– 100dB below full output (flat)
NOISE	–116dB below full output (flat,20kHz bandwidth)
2nd HARMONIC DISTORTION	<0,001% at 1kHz (0,0007% on prototypes) at 100W output using a ±56V supply rated at 4A continuous <0,003% at 10kHz and 100W
3rd HARMONIC DISTORTION	<0,0003% for all frequencies less than 10kHz and all powers below clipping
TOTAL HARMONIC DISTORTION	Determined by 2nd harmonic distortion (see above)
INTERMODULATION DISTORTION	<0,003% at 100W (50Hz and 7kHz mixed 4;1)
STABILITY	Unconditional

In "2001" Arthur C. Clarkes Black Monolith symbolised awesome power – intelligence.
So too do the 5000 "BLACK MONOLITH" Power Mosfet amp kits from Jaycar.
Why would you choose a Jaycar "BLACK MONOLITH" 5000 Power amp over conventional kits? Because you, too are intelligent.
You have seen the specs, and you know that this amp IS the best. You want the best because (whether you know it or not) you are a perfectionist. You won't be conned by cheap and nasty compromises to David Tillbrook's brilliant design. You will want to know if there have been mods to the original design. (There have – and only Jaycar kits reflect them). But let's be specific about the improvements.

- Completely redesigned flag heatsinks for the Driver Transistors. Thoroughly endorsed by David Tillbrook. (The original ones were too small if the bias current was set high for low distortion).
- Ventilation grilles in the covers. These were not included in the original design.
- Blind tapped holes in the exclusive 'Superfinish'® front panel. Heavy gauge screws used for stronger connection of the heatsink bracket to the panel.
- Jig drilled, EXTRUDED, deburred and black anodised heatsink bracket in heavy gauge. All other kits we have seen, a flimsy punched out piece of sheet metal is supplied. Not even anodised!! This is one of the most critical components in the kit.
- Beryllium Oxide heatsink washers supplied. A tube of heatsink compound is also supplied – with enough left over to use elsewhere.
- 'Superfinish'® Front Panel. Despite what others may claim ours is still the best.
- Dual 3 Pin DIN 30V Power Outlets. This extra power outlet enables you to power extra 5000 series components as they arrive on the scene.
- And all of the extra features of our normal Superfinish 5000 amp, like: Metal 1% film resistors, Pre-wound Chokes, Fibreglass PCB's, Heavy Duty Earth Braid, Quality Capacitors, Original Chassis - bar design, Flux shorting straps on transformers etc., etc.

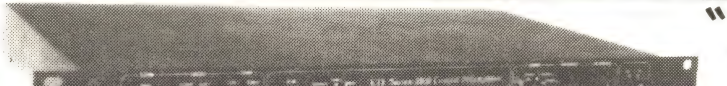
The Jaycar "BLACK MONOLITH" is worth far more than the inferior kits around the market today. That goes without saying.

BUT IT COSTS NO MORE!

That's right. FOR THE MOMENT we are holding our price on this kit to a staggering low $299. We probably won't be able to keep this quality kit below $300 for long.
We all enjoyed '2001' for the first time a long time ago now. You can enjoy your 5000 "BLACK MONOLITH" forever!

ONLY $299– PAY NO MORE!!!

'Superfinish' Panel has Blind Tapped Holes



"BLUEPRINT" * * *

5000 PREAMPLIFIER

The refinement continues. The silk screen stencil for the front panel is renewed after every run of 25 panels. This ensures the crispest possible lettering. Note that ONLY JAYCAR use the ORIGINAL ETI front panel design. Don't get caught with something you may not like the look of! We use the extra high quality LM394H in the M.C. preamp. and now AT NO EXTRA CHARGE supply gold plated RCA sockets on all inputs, not just the M.C. input.
Despite what others may say, their's is not as good as the original BLUEPRINT Preamp. They do not, for example, get special low capacitance screened cable made to Jaycar specs. just for the preamp. (It's made in Australia, not Taiwan).

AMONG OTHER FEATURES OF THE BLUEPRINT

- EXTREMELY CLOSE TRACKING TO RIAA EQUALISATION.
- ENGLISH 'LORLIN' LOW NOISE SELECTOR SWITCHES USED
- LOW NOISE 1% METAL FILM RESTISTORS USED
- TINNED F/GLASS PCB'S
- QUALITY IC SOCKETS PROVIDED
- SPECIAL REAR PANEL
- MULTICOLOURED LED DISPLAY (EASIER TO READ & BETTER LOOKING)
- THERMALLOY HEASINK USED ON REGULATOR

We still have the standard $245 version of this kit which is better than the other $245 kits. We don't sell many though – the BLUEPRINT is better value. 'BLUEPRINT' ONLY $275.

FROM $245
BLUEPRINT $275

SPECIFICATIONS

Frequency Response	High level input 15Hz 130kHz, +0, 1dB Low level input conforms to RIAA equalisation ±0 2dB (see detail on Phono specs)
Distortion	1kHz < 0,003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N noise	High level input, master full, with respect to 300mV input signal at full output (1 2V) > 92dB flat, > 100dB A-weighted MM input, master full, with respect to full output (1 2V) at 5mV input, 500 ohm source resistance connected > 86dB flat > 92dB A-weighted MC input, master full with respect to full output (1 2V) and 200uV input signal > 71dB flat > 75dB A-weighted

ETI-478MM Moving Magnet input stage

Gain	≈ 1kHz			
Frequency Response	Conforms to RIAA Equalisation ±0 2dB			
Total Harmonic Disorder	< 0 001 , 1kHz 10mV RMS input			
Headroom	> 28dB with respect to 5mV RMS input signal i.e. 135mV RMS			
Noise	Total equivalent input noise 122nV A input shorted 216nV flat input shorted			
S/N ratio		1mV	5mV	10mV
	Flat	73dB	87dB	93dB
	A weighted	78dB	92dB	98dB

ETI-478MC Moving coil input stage

Gain	24
Frequency Response	7Hz 135kHz +0 1dB
Total Harmonic Disorder	< 0 003 , 1kHz 30mV input
Noise	Total equivalent input noise 83nV flat, input shorted 42nV A , input shorted 56nV flat after RIAA Eq input shorted 34nV A , after RIAA Eq input shorted

AT LAST!!! THE NEW 8 CHANNEL MIXER KIT

† Balanced (600 ohm) mic inputs/line inputs † Balanced output † Input attenuators † Cannon connectors included in the price † Bass, mid & treble equalization on each input † "Effects" (i.e. echo etc) capability † Foldback on all 8 inputs † Stereo pan on all 8 inputs † 60mm slide faders used throughout † 19" rack mount capability (or console mount) † Professional black front panel with format borders and multicoloured knobs to assist function identification † Designed for quick easy service † VU metering † Only high quality components used † 5534A OP amp used for low noise and very low distortion.

BASIC MIXER KIT with all features. Includes 19" rack panel all knobs and electronic components AND 10 CANNON connectors $495

Console mount chassis in steel, plated and pre-punched. Includes power supply for mixer and wooden end pieces. $98

OUTPUT SHORT–CIRCUIT PROOF

FROM $495

Jaycar

125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293
Mail Orders To:
Box K-39 Haymarket 2000
Post and Packing charges
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

JAYCAR DEALER– G&J ELECTRICS, FORRESTERS BEACH. NSW 2260. PHONE (043) 845787

SEND SAE FOR FULL DATA ON 5000 SERIES &/OR MIXER

SEPTEMBER 1ST– OPENING AT CARLINGFORD!!!

Books & Literature

Technology and employment

MICRO INVADERS, How the new world of technology works, by Ian Reinecke. Published 1982 by Penguin Books Australia. Paperback, 183 x 111mm, 272 pages. ISBN 0 14 005976 8. Price $6.95.

From the outset, Ian Reinecke sets out to show that he is not fooled by all the razzmattaz for the new technology. He styles himself as a "techno sceptic" while those who are keen on introducing new technology are "techno boosters" and those who are uncertain about the efforts of these new developments while looking hopefully towards the future are the "techno pragmatists".

Having started the dialogue at this dismally low level, the author then attempts to give a straightforward description of most of the technical innovations of the past 10 years or so. Unfortunately, while he is a self-proclaimed sceptic, he is not particularly well informed.

The most blatant instance of this is in his mention of fibre optic cables. He implies that they have an advantage over copper since the raw material is sand and fibre optic cables need fewer boosters than copper cables! That displays a woeful lack of understanding of the technology involved.

Actually I found the book quite tedious to read. Just as there are some books that you "just cannot put down", I found Reinecke's difficult to pick up. While I certainly would not think of myself as a techno-booster, I found his presentation of the "facts" so contentious that I occasionally threw the book into a corner in disgust.

As an example of his trivialisation of the issues consider his reaction to the incorporation of computers into cars to control ignition and fuel systems, "For most of us, contact with the micro chip in the forseeable future will be limited to opening the car bonnet and staring blankly at black boxes. Without programming ability or an ability to repair intricate electronic circuits, we will be powerless to repair faults. A shifting spanner and a screwdriver in the trunk will no longer be enough."

While it certainly may be more difficult to repair cars with computer electronics, they are equally certain to be more reliable and efficient. And when was the time when a "shifting spanner and a screwdriver in the trunk" was adequate to make running repairs, presupposing that the average driver ever had enough knowledge to do this?

In summary, I give Ian Reinecke low marks for this effort. It does little to inform and is not worthy of an experienced journalist. My advice to readers wishing to learn about the likely effects of technology is to avoid books that have catchy titles such as this. (L.D.S.)

Talking Computers

TEACHING YOUR COMPUTER TO TALK: by Edward R. R. Teja. Soft covers, 208 pages, 130mm x 210mm, illustrated with photos and diagrams published by TAB Books Inc 1981. ISBN 0 8306 1330 7. $13.95

This book is intended to provide basic source material on computer speech synthesis and recognition. It describes the various techniques of electronic speech synthesis, answers questions such as "Why bother?" and describes in detail several commercially available speech synthesis peripherals.

The author of this book is an Associate Editor for the US professional electronics journal "EDN", and this book grew out of a series of articles published in that magazine.

Although billed as "a do-it-yourself guide to one of the most exciting new concepts in computer technology for hobbyists and experimenters", the book is very short on practical circuits and applications. Instead it concentrates on commercially available equipment such as the Cognivox and National Semiconductor's Digitalker. The one practical circuit is for equipment which directly stores digitised speech and plays it back, a method requiring a lot of free memory in the computer system.

The chapters on the theory of speech production and synthesis are good. Details of interfacing and programming speech I/O devices from several manufacturers are given in later chapters, and these are a useful guide to using commercial systems. The single chapter on applications of speech technology is brief, and covers subjects such as talking clocks, a voice controlled dialler and voice response aircraft control systems.

The book concludes with three appendices; one a list of United States manufacturers of speech peripherals, another a list of further reading and the last a list of the "ARPABET" phonetic spelling code used by some speech synthesis programs. The strong point of this book is its comparison of the features and costs of various commercial equipment and the details it provides about speech systems already in use. To live up to its claim to supply everything needed for practical experience with speech synthesis much more detail would be required.

Our review copy came from McGills Authorised Newsagency, 187 Elizabeth St, Melbourne, Vic, 3000. (PV)

6809 reference

The 6809 COMPANION: M. James. Soft covers, 88 pages, 110mm x 177mm. Published by Bernard Babani Ltd, 1982 ISBN 0 85934 077 5. $5.85.

This little book will be of interest to anyone using the Motorola 6809 microprocessor. It is a handy reference to subjects such as the history and architecture of the processor, addressing modes and the instruction set.

In all there are eight chapters, the first comparing the 6809 to its predecessor, the 6800, the second examining the processor's internal registers and operations, and a third on addressing modes. Later chapters discuss the instruction set in detail and other useful topics for the machine language programmer.

Additional chapters discuss converting programs from the 6800 for the 6809, programming style, interrupt handling and the availability of 6809 hardware and software. As a reference, the book is not an introductory text, but is useful to those who already have some knowledge of this particular microprocessor and are looking for a convenient summary of vital information.

The book has been prepared on a Centronics 737 printer, and the printed output photographically reduced to make up the pages of the text. As such, the typeface is tiny although still readable but this is certainly not an expensive production.

Our review copy came from The Technical Book and Magazine Company Pty Ltd, 289-299 Swanston St, Melbourne, Vic. 3000. (P.V.)

Books recently received

FIBRE OPTICS. IERE Conference Proceedings No. 53. Soft covers, 200 pages, 210x292mm, illustrated. ISBN 0 903748 48 7. Price £27.00.

This book contains the complete proceedings of the International Conference on the above subject held in London on March 1-2, 1982. Twenty papers were presented in all, on subjects such as a 140Mbit/s long haul optical fibre system, effects of nuclear radiation on optical fibres, IEC standards and portable test equipment.

For those working in the field of fibre optics, this should be a most useful reference. It is priced at £27 including postage. Contact: Publication Sales Controller, Institution of Electronics and Radio Engineers, 99 Gower Street, London UK WC1E 6AZ.

INTERMEDIATE PROGRAMMING FOR THE TRS-80 (Model 1), by David L. Heiserman. Published 1982 by Howard W. Sams, Indianapolis. Soft covers, 135 x 217mm, 238 pages, illustrated with program listings. ISBN 0 672 21809 7. $14.95.

This text has been written for those already familiar with programming the TRS-80 and who wish to use some of the hidden features of this machine. Also discussed is T-Bug and an editor/assembler for this machine. The book is available from McGills Newsagency, Melbourne.

KIT CONSTRUCTORS' REFERENCE MANUAL.

Bill Edge's Electronic Agencies have produced an eight-page foolscap sized booklet with a lot of useful and up-to-date information for the hobbyist. Featured are sections on tools, soldering, passive and frequently used active components, using a multimeter, wire and cable, and so on. Most useful.

It is priced at 50c but is normally included free with every kit costing more than $20.

NEW BOOKS

NEW — NEW — NEW

Latest editions of some of the most popular books on the subject.

World Radio TV Handbook 1982 Edition — order now from our advance shipment. Airfreight copies here now	$21.95
The Radio Amateur's Handbook — APRIL 1982 Edition Just Out! A must for the Radio Amateur and Professional	$14.95
RSGB Handbook Volume 1	$21.85
RSGB Handbook Volume 2	$18.90
Reference Data for Radio Engineers (New Edition) ITT	$39.95
Australian Amateur Operator's Handbook — Postal & Telcommunications Department	$3.60

Computer Books

Creative Computing Vol 3 — Ah1	$10.75
Digital Counter Handbook — Frenzel	$14.75
Discovering computers — Gledhill	$10.95
40 Computer Games from Kilobaud Microcomputing	$9.55
TRS-80 disk & other Mysteries — Pennington	$25.15
The Basic Handbook — Lien	$17.95
Learning Basic Fast — DeRossi	$13.95
6502 — Software Design — scanlon	$14.20
TRS-80 BASIC — Self-Teaching Guide — Albrecht, Inman & Samora	$12.55
TRS-80 Interfacing Book 1 — Titus	$11.95
Basic Programming Primer — Waite & Pardee	$12.70
Microcomputer Interfacing with the 8255 PPI Chip — Goldsbrough	$11.95
Musical Applications of Microprocessors — Hal Chamberlin	$36.00
Digital Troubleshooting — Gasperini	$16.00

Adam Osborne Books:

Apple II User's Guide — Poole	$19.00
Business System Buyer's Guide — Osborne with Cook	$11.30
Basic User Guide — Osborne	$19.00
CRT Controller Handbook — Kane	$9.90
CP/M User Guide — Hogan	$17.80
Osborne 4 & 8-bit Microprocessor Handbook — Osborne	$25.00
Osborne 16-bit Microprocessor Handbook — Includes 2900 Chip Slice Family — Osborne	$25.00
PET/CBM Personal Computer Guide — Osborne	$19.00
A User Guide to the UNIX System — Thomas	$20.00
6502 Assembly Language Programming — Leventhal	$21.30
6800 Assembly Language Programming — Leventhal	$20.00
8080A-8085 Assembly Language Programming — Leventhal	$20.00
Introduction to Microcomputers, Osborne Vol 0 — Beginners Book	$9.55
Vol 1 — Basic Concepts 2nd ed	$17.80
Vol 2 — Some Real Microprocessors — New Edition, Looseleaf	$30.00
Vol 3 — Some Real Support Devices — New Edition, Looseleaf	$16.50
6800 Programming for Logic Design	$11.40
8080 Programming for Logic Design	$12.55
Z80 Assembly Language Programming	$13.80
Z80 Programming for Logic Design	$11.40

Byte Books new series on Computers:

Mondeb — An advanced M6800 Monitor Debugger — Peters	$7.00
Tiny Assembly 6800 Version 3.1 — Emmerichs	$12.60
K2FDOS — A Floppy Disk operating System for the 8080 — Welles	$27.60
Ciarcia's Circuit cellar — Ciarcia	$11.20
Tracer — 6800 Debugging Program — Grappel	$8.40
Link 68 — an M6800 Linking Loader — Grappel	$11.20
Byte Book of Computer Music — Morgan	$13.80
RA6800ML — Relocatable Macro Assembler — Hemenway	$35.00
Numers in Theory and Practice — Programming Techniques — Liffick	$12.55
Byte Book of Pascal — Liffick	$35.00
Build your own Z80 Computer — Steve Ciarcia	$22.05

Sybex Computer Books:

Apple Pascal Games — Hergert & Kalash	$17.95
Programming the 6502 (Vol 1)	$17.95
Programming Exercise for the 6502 (Vol 2)	$17.50
6502 Applications Books (Vol 3)	$17.50
6502 Games Book (Vol 4)	$17.50
Basic Programs for Scientists & Engineers	$19.95
CP/M Handbook (With MP/M)	$18.95
Don't (or How To Care For Your Computer)	$15.95

Just a few of the thousands in stock. Call in or write. Prices subject to fluctuation. Correct at time of going to press.

If the book you require is not listed below, it can be ordered from us.

Easing into Pascal with UCSD Systems	$19.95
Fifty Basic Exercises	$17.50
Fifty Pascal Programs	$17.95
Inside Basic Games	$19.95
Introduction to Pascal (Including UCSD Pascal)	$19.95
Introduction to Personal & Business Computing	$9.50
Microprocessor Interfacing Techniques	$23.50
Microprocessors: From Chips to Systems	$17.50
Microprogrammed APL Implementation	$45.95
Pascal Handbook	$24.95
Pascal Programs for Scientists & Engineers	$22.50
Programming the Z800	$19.95
Programming the Z80	$19.95
Sybex Book of Pascal Games	$19.95
Your First Computer — A Guide to Business & Personal Computing	$11.95

Amateur Radio

ARRL Antenna Handbook	$8.30
The Radio Amateur's License Manual	$6.80
FM & Repeater for the Radio Amateur	$8.80
Single Sideband for the Radio Amateur	$8.00
Ham Radio Operating Guide	$7.20
Electronics Data Book	$7.20
Solid State Design for the Radio Amateur	$9.80
ARRL Antenna Anthology	$6.80
The Contest Cookbook — Zachary	$7.95
The Magic of Ham Radio (History) — Swank	$6.60
New Zealand ART Call Book 1981	$5.85
VHF Antenna Handbook — Barvicks	$8.50

Howard W. Sams Books

TTL Cookbook (Lancaster)	$12.95
TV Typewriter Cookbook (Lancaster)	$13.50
The Cheap Video Cookbook (Lancaster)	$10.75
Active Filter Cookbook (Lancaster)	$19.95
Transistor Substitution Handbook	$7.95
TTL Cookbook (Lancaster)	$12.95
IC Op Amp Cookbook — Jung — New 2nd Edition	$19.95
Applesoft Language — Blackwood	$12.95
The S-100 and other MicroBuses — Goodwin & Poe	$11.95
Pascal Primer — Fox & Waite	$22.95
Intimate Instructions in Integer Basic — Blackwood	$9.95
Experiments in Artificial Intelligence for Small Computers — Krutch	$11.95
Basic Business Software — Brooner	$15.95
Microcomputer Dictionary — Sippl	$18.95

Other Titles

Practical Transformer Design Handbook — Lowdon	$32.95
Complete Handbook of Robotics — Safford Jnr	$11.50
How to Build your own Working Robot Pet — DaCosta	$9.95
The Active Filter Handbook — Tedeschi	$11.50
How to Design & Build your own Custom TV Games — Heiserman	$13.50
Piano Servicing & Tuning & Rebuilding — Arthur Reblitz	$21.00
Hi-Fi Loudspeakers & Enclosures — Cohen	$25.50
How to build your own self-programming Robot — David Heiserman	$9.95
Fairchild — CMOS Data Book	$9.95
Motorola M6800 Microprocessor Applications Manual	$16.70
Motorola MC6800 16-BIT Microprocessor User's Manual	$25.00
Motorola Programming the 6800 Microprocessor	$11.05
National CMOS Databook	$7.50
National Linear Databook	$11.25
National Logic Databook	$10.00
National Audio/Radio Handbook	$6.25
Video Games — Len Buckwalter	$5.95
Videocassette Recorders Theory & Servicing — McGinty	$20.00

MAIL ORDERS BY RETURN
PLEASE ADD $1.50 per parcel postage (Vic)
$2.50 per parcel interstate

TECHNICAL BOOK & MAGAZINE CO.
295-299 Swanston St, MELBOURNE 3000. Ph. 663 3951.

DICK'S DIRECT IMPORT PRICES

SAVE ON 40CH

NOW FULLY APPROVED

Cat. D-1447

40Ch AM
STALKER VIII

Don't take chances in buying CB radio . . . buy your CB from Dick Smith, Australia's CB expert!

The superb Stalker VIII CB features the new legal 40 channels, complete with microphone and mounting bracket.

Large LED channel readout, easy to use and has maximum legal output.

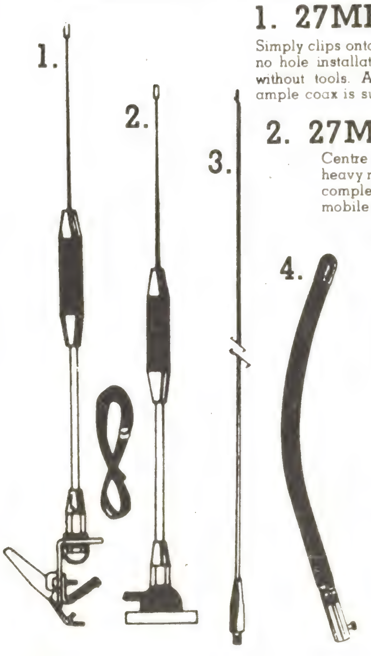
FANTASTIC VALUE!

DOC Approval No
249A001

~~$149.00~~

NOW ONLY

$97.50



1. 27MHz Gutter Grip

Simply clips onto the rain gutter of any vehicle. Features no hole installation and can be installed or removed without tools. Antenna has centre loading coil and ample coax is supplied. Cat. D-4411 **$19.50**

2. 27MHz Magnet Base

Centre loaded stainless steel construction with heavy magnetic base. 16 feet of coax supplied, complete with PL259 plug. Ideal for 'instant' mobile use. Cat. D-4412 **$25.00**

3. ¼ Wave Whips

Your choice of stainless steel or fibreglass. Each is approx. 2.75m long, ideal for marine or CB use.

Cat. D-4415 **$15.50**

Cat. D-4416 **$19.95**

4. 'Rubber Duck'

Indestructable and very flexible, perfect for handheld sets. Only 300mm long, great replacement antenna! Cat. D-4629 **$8.50**

Cat. D-1710

SAVE $40!

40Ch AM/SSB
DICK SMITH HORNET II

This unit is the latest in 40 channel CB technology. With the massive 12 watts p.e.p. output on SSB, this set meets the high DOC standard RB249A. Frequency range is 26.965MHz to 27.405MHz and accessories include DC power cable with built-in fuse and microphone clip.

WAS ~~$239.50~~

DOC Approval No.
249A006

THIS MONTH ONLY $199

TOP VALUE HAND HELD

Cat. D-1102

For the weekend boatmen who don't want the more expensive full power transceivers, but who still need that reassurance of having a safety transceiver on board. Three channels available, one fitted with 27.620MHz, the others left blank for your own choices. Crystals are reasonably priced and easy to fit. This set takes 8 'AA' pencell batteries.

MAX. LEGAL POWER $51.00

FULL RANGE OF ACCESSORIES AT LOW DICK SMITH PRICES!

DICK SMITH Electronics

See Page 124 for address details

bankcard welcome here

Terms available to approved applicants through . . . HFC

®

Shortwave Scene

by Arthur Cushen, MBE

Big expansion program for Radio France

The French Government has announced plans to boost the power, and the number of program hours and languages carried by Radio France International. It claims that by 1987, at the end of the five year development project, Radio France will surpass the BBC in world coverage.

In the past, Radio France International has restricted its broadcasts in French to Africa and to some Eastern European languages, with only one broadcast in English each day. By 1987 Radio France International should be broadcasting to the whole of Africa, Latin America, Asia and the Middle East in 17 languages with a weekly broadcasting output of 739 hours as against the present 125 hours.

The plan will also mean the increase of transmitter facilities, from the present 20 transmitters, to 40. There will be new relay bases established with Africa No. 1 at Gabon already used to carry programs and a relay base in French Guyana now being constructed.

The expansion plans include the introduction in 1983 of a service to the Middle East, and by 1985 the final target will be reached with broadcasts to Asia in French, Standard Chinese, Laotian, Cambodian and Vietnamese. According to the BBC Monitoring Service the transcription service of Radio France International will also be expanded.

LATIN AMERICAN NEWS

COLOMBIA: Radio Transamazonica on 6035kHz continues to be received opening at 1000UTC and reports should be addressed to Apt Aereo 16555, Bogata, Colombia. Around 1100UTC there is interference from Radio Nacional, Costa Rica on the same frequency.

ECUADOR: La Voz del Rio Tarqui on 3285kHz has been heard at 1100UTC with news and then Spanish programming, reports Geoff Cosier and Chris Rogers in DX Post.

PERU: Radio Esmeralda has been heard on the unusual frequency of 3800kHz at 0925UTC. Music programs were observed up to 0950 when news in Spanish was observed. Radio Satellite, also out of band on 6726kHz, was noted at 1143UTC with music and heard to past 1200UTC.

SURINAM: Radio Apintie has been heard on a new frequency of 4995kHz at 0915 with a program in Hindi and at 0930 transmissions continue in Dutch.

URUGUAY: Montevideo, La Radio on 6034kHz has been heard by four Melbourne listeners at 0735UTC, according to DX Post. In New Zealand, Bryan Clark reporting in the DX Times notes the station with an all news format at 0707UTC.

VENEZUELA: Many signals are noted in the 60 metre band around 1000UTC with one of the most interesting being Radio Maracaibo which has appeared on 4860kHz. Radio Continente on 5030kHz is one of the strongest, heard at 0930UTC.

AFRICAN SIGNALS

The equinox period March and August is the time when signals from Africa are received at dawn and dusk, and Ray Crawford of Gladstone, Queensland supplies a list of signals from that part of the world that should be heard during this month.

3255kHz: ELWA Monrovia, Liberia noted with news in English at 1900UTC.

3320kHz: Johannesburg, South Africa has a telephone talk show at 1930 and orchestral programming after 2000UTC.

3326kHz: Lagos, Nigeria has English news at 2000UTC.

3396kHz: Harare, Zimbabwe has five minutes of news in English at 2000UTC.

6190kHz: Maseru, Lesotho BBC Relay of World Service closing 2030UTC.

MIDDLE EAST NEWS

CYPRUS: The Cyprus Broadcasting Corporation, Nicosia, is heard with a transmission 2210-2245UTC on Friday, Saturday and Sunday. The broadcast is now carried on 7230 and 9635kHz. The best reception is on 7230kHz as 9635 suffers some interference from the Vatican Radio.

TURKEY: The Voice of Turkey has made major frequency changes for its two transmissions in English which are heard at 2030-2130 on 9625kHz and 2200-2300 on 7155, 9560 and 11770kHz. The first transmission is well received, but the second broadcast has interference on all three frequencies with Radio Australia on 11770 causing co-channel problems at the commencement of the transmission. The broadcast between 2130-2200 is in French and this is best received on 7155kHz, while at 2230UTC, 11770kHz gives the best reception as it is beamed to South East Asia.

NEW FREQUENCIES

PORTUGAL: Radio Renascenca in Lisbon has been heard broadcasting in Portuguese to Brazil on 11730kHz at 2330-0130UTC. This new service is well received when opening transmission with the interval signal and the station uses "April in Portugal" as its theme for its Catholic broadcast. Transmissions to Europe have been observed more recently on 9595kHz at 1830UTC.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

DO YOU WANT TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by Telecom. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.

For further information, write to

THE COURSE SUPERVISOR
W.I.A. (N.S.W. DIVISION)
P.O. Box 123,
ST. LEONARDS, N.S.W. 2065.

RADIO DESPATCH SERVICE

869 George St., Sydney,
NSW 2000 *(Near Harris Street)*
Phone 211 0816 •211 0191
Open: Mon-Fri 8am to 5.30pm
Thursday night late shopping
till 8.30pm Sat 8am to 11.45am

MAIL ORDER CUSTOMERS

P&P CHARGES:

Local (NSW)	$3.50
Interstate	$4.50

FLUKE®

DIGITAL MULTIMETERS

HANDHELD MODELS

	Tx Ex $	Tx Paid $
8020B	210.00	238.48
8021B	165.00	187.38
8022B	155.00	176.02
8024B	265.00	300.94
Case	15.00	17.03

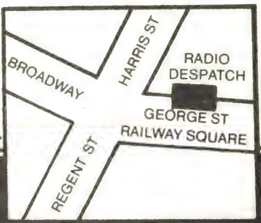
(All handheld models)

BENCH MODELS

	Tx Ex $	Tx Paid $
8010A	290.00	329.33
8012A	375.00	425.86
8050A	415.00	471.28
Case	40.00	45.43
(8010A & 8012A only)		
Case	55.00	62.46

Note:
Handheld DMM's include battery, test leads, instruction manual, pocket-size operator's card and certificate of calibration.
Benchtop DMM's include line cord, test leads, instruction manual, and certificate of calibration.

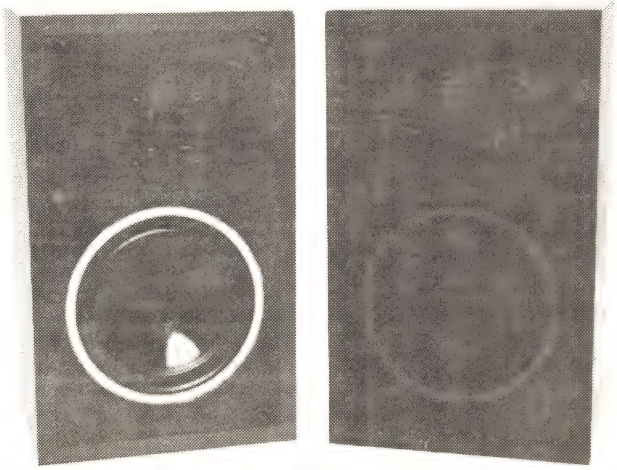
COME AND SEE US NOW!



MAIL ORDERS TO: RADIO DESPATCH SERVICE
869 George St., Sydney 2000 Phones: (02) 211 0191 • 211 0816

Coming Next Month * * *

Audax Loudspeaker System



Using French-made drivers which are employed in some of the best British loudspeaker systems, this high-quality two-way system is ideal where space is at a premium.

Stereo Synthesiser

Held over from the August issue, this unit has been designed especially for Video Cassette Recorder users. The circuit employs a bucket brigade device to simulate a comb filter and thereby produce an evenly spread stereo effect from a mono signal. It can also be used to enhance normal stereo signals.

Fluorescent Starter

Do your fluorescent lights shatter your composure and blind you with their blinkety-blink turn-ons? Solve all that with a solid-state starter.

ON SALE: Wednesday, September 1st

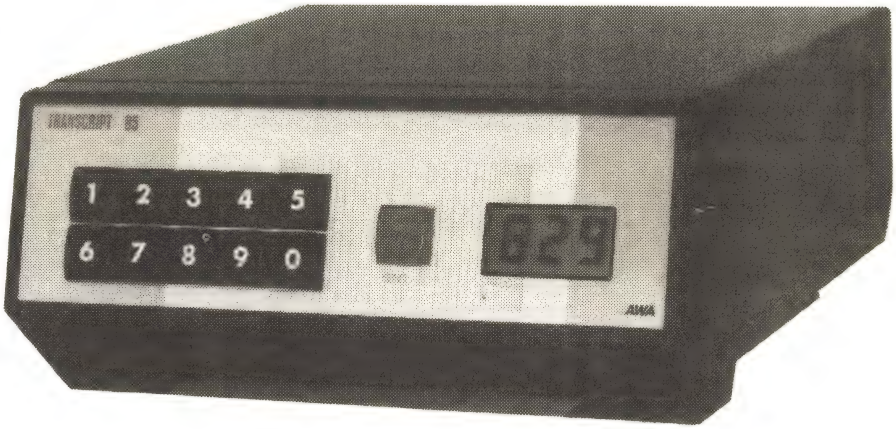
* Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

New Products...

Product reviews, releases & services

Transcript 85: new AWA printer for mobile radio

AWA Ltd now has available a printer unit for use in conjunction with its range of mobile radio units.



AWA printer unit allows a radio telephone operator to receive printed data.

More than 60 years of experience in mobile radio communications is reflected in the new mobile radio printer released recently by Amalgamated Wireless (Australasia) Ltd.

The AWA "Transcript 85" is a single piece mobile printer/status display unit specifically designed for interfacing with the AWA Carphone RT-80 series equipment in mobile radio communications systems.

Housed in a fibreglass case with dimensions of 206mm x 215mm x 95mm (W x D x H) and meeting EIA specifications on vibration resistance, the Transcript 85 can be mounted in most passenger and commercial vehicles.

Hard copy messages can be transmitted to any one of 4000 individual vehicles or groups of vehicles in a fleet, with or without the supervision of the mobile operator.

Developed in conjunction with Deltec Pacific Pty Ltd of Perth, the unit prints received messages on a 40 column printer using metallised paper.

Status display facilities using pushbutton controls and a liquid crystal display allow each mobile operator to send one of more than 10,000 pre-selected coded messages simply by pressing a button. If the channel is busy, the Transcript 85 will store the commands and send them once the channel is clear.

For more information contact Amalgamated Wireless (Australasia) Ltd, 554 Parramatta Road, Ashfield, NSW, 2131.

New two-tape answering machine

Telephone answering machine from Dick Smith Electronics uses two microcassettes, one for pre-recorded message to caller and one for recording incoming messages.

Dick Smith Electronics has a new telephone answering machine available. The two-tape machine comes with a full range of features, including an "Answer only" function, the ability to monitor incoming calls, and an indication that the last recorded message has been played.

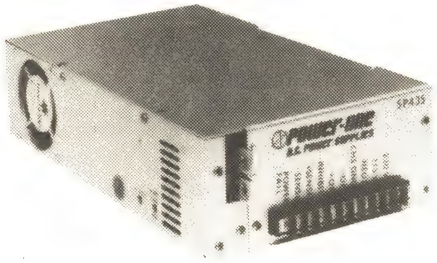
To avoid recording the message to callers up to 30 times at appropriate intervals on the same tape as used for recording incoming calls (as with single tape answering machines), the two-tape machine uses separate cassettes for each function. The message need be recorded only once, and the full running time of the second tape is available for recording messages from callers.

The answering machine uses standard "micro-cassette" tapes, and an optional remote control beeper is available. Using the beeper the owner can call up the answering machine from any telephone and play back recorded messages.

For more information contact any Dick Smith Electronics store.

Power One switch-mode power supplies

A new range of switch-mode power supplies for computer and office equipment, has been announced by Warburton Franki, Australian agent for the makers, Power One.



The SN series offers high power output (up to 600W) in a compact 8.5cm high package. Applications include office equipment, computer peripherals, and small mainframe computers.

Each power supply features dual input capabilities of 90-130VAC or 180-260VAC, and internal RFI/EMI shielding is included as standard. Models are available with outputs of 5V at up to 120A.

For more information contact the nearest Warburton Franki office.

High power Darlingtons

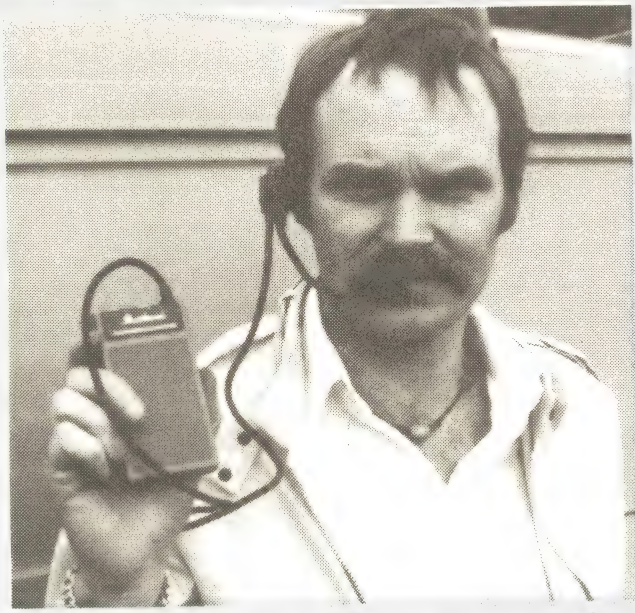
Motorola Inc has introduced six new high power Darlington transistors for energy control applications. The devices are rated at 50, 100 and 200 amps with V_{CEO} ratings ranging from 200V to 850V.

The Darlingtons are intended for high power switching in applications such as pulse-width modulated motor controls, high power inverters, switching regulators and uninterruptible power supplies.

A feature of the new devices is their packaging; JEDEC MD-040AA plastic packages capable of dissipating 500W.

For more information contact Motorola Semiconductor Products (Sydney), 250 Pacific Hwy, Crows Nest,

Hands free operation for new transceiver



"Shuttlecock" transceiver has voice operated transmit switch and headset to leave the user's hands free for other tasks.

A new transceiver released by a Melbourne company provides voice activated two-way communication while leaving the operator's hands free.

The "Shuttlecock" transceiver is designed for special purpose applications in businesses such as construction, electrical maintenance, security, warehousing and manufacturing — anywhere that requires radio communication while leaving both hands free for safety and convenience.

The transceiver can be carried in a pocket or slung on a belt, and provides communication in the 49MHz FM band for distances of up to half a kilometre. A choice of five channels is available.

The unit comes complete with a stowable whip antenna and an adjustable boom mounted microphone with a windscreen, allowing use even in high noise environments. The circuitry includes audio muting and a microphone sensitivity control, all for a suggested retail price of $109.

Shuttlecock is available from Truscott Electronics, Cnr Eastfield and Bayswater Roads, South Croydon, Victoria.

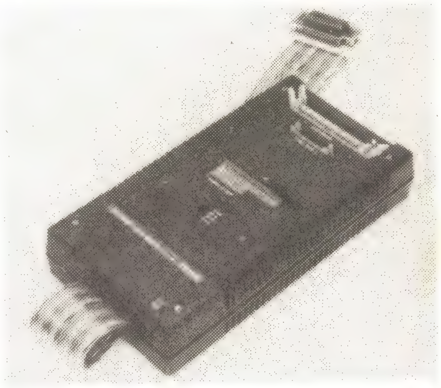
Extension of Philips' development system

The Philips microcomputer development system (PMDS) is said to be the first development system to support the Intel 8400 family of single chip 8-bit microcomputers.

A feature of the 8400 family is the serial input/output interface which eliminates the intensive processing normally associated with serial data transfer. The serial I/O capability can be fully exploited using the Philip's development system in writing applications programs.

The main elements of the support package are a cross-assembler and a hardware interface adapter for connecting a prototype 8400 system to the rest of the PMDS. The 8400 is available in several versions, including one with 1K of ROM and 64 bytes of internal RAM, and one with 4K of ROM and 128 bytes of RAM on board.

Architecture and pin configuration is similar to that of the Intel 8021 microcomputer, while the instruction set is based on the Intel 8048 processor.



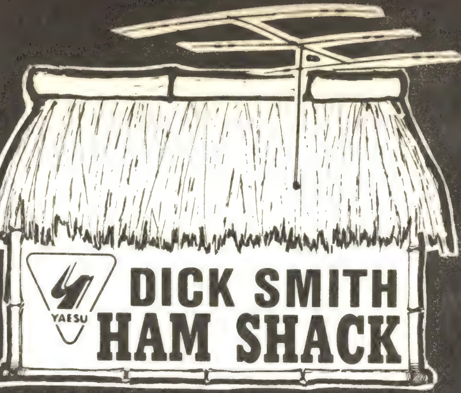
PMDS hardware adaptor for 8400 micro.

All standard PMDS debugging commands are available, and the contents of all registers, including the serial I/O registers, can be displayed in the single step mode. Clock frequencies up to the full running speed of the processor (4.43MHz) can be used.

For more information contact Philips Scientific and Industrial Equipment, 25-27 Paul Street, North Ryde, NSW 2113.

DON'T MISS OUT!

Check out the Yaesu bargains in my new Ham Shacks



Dick Smith Ham Shacks are located in the Dick Smith stores listed below. You'll find a licensed amateur at each shack — someone who can talk your language and give you any help you need. (Amateur items also available at other Dick Smith stores.)

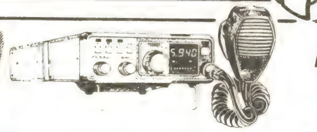
FT-ONE — The ultimate

Top of the line - it's got everything: SSB AM - RTTY - CW - FM* - 100W PEP - Built in power supply Cat D-2852

ONLY $1975

(*Option) General Coverage 150kHz - 30MHz

FT 720 RVH 2m



FM — 25 watt — it goes remote scanning & memories. Cat D-2890

$369.95

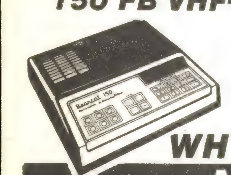
SPECIAL - AUGUST ONLY
Remote cable only $10
Hurry while stocks last!

TH 3JR HF Antenna

Triband (10-15-20 mtrs) beam, 12' boom, 600W PEP. Approx. 8db gain, 25db F/B. Cat D-4304.

ONLY $275

150 FB VHF-UHF SCANNER



Hear it all! Touch control — fully synthesised. Cat D-2800

ONLY $275

WHY PAY MORE?

FT 480R

Big gun — all mode. It's got it all in such a small package. 1 & 10 watt output plus scanning plus memory plus NB plus tone burst plus priority ch. plus 2 VFO's plus satellite operation. Cat D-2887

only $514

FT 208R 2m

FM - hand held, 800 chan. loaded with features: LCD, 10 memories, scanning, hi/lo power, touch tone, memory backup, and comes complete with charger and battery. Cat D-2889.

WAS ~~$368~~ **only $325**

NEW

FT 102

Big power — 3 x 6146B — built in power supply — all WARC bands — super dynamic range — best ever! Cat D-2880.

and it's only $1195

V5JR HF Antenna

5 band (80-40-20-15-10 mtrs) vertical. 1 kw PEP, 6.7m high, very good for limited space applications. Cat D-4305.

ONLY $99

NEW

5/8 WAVE 2 mtr Whip

Fits our standard ⅜ base (D-4056). 1.3m long — fibreglass construction. Cat D-4205.

ONLY $14.95

FT 230R 2m

ONLY $359

Super compact FM 3/25 watt synthesised — LCD — 2 VFO's — 10 memory plus scanning. It's out of sight 2m radio!! Cat D-2893

FT 101Z (FM)

Old reliable — the famous 101 with FM and all the WARC bands too. Cat D-2872.

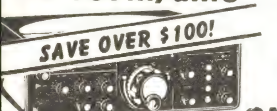
ONLY $885

FT 707 HF MOBILE

Car/boat/plane or even home. This is the hot little giant, all solid state 100W PEP, all WARC bands too! Cat D-2869

only $765 WAS ~~$795~~

FT 107m/dms



Solid state — built in power supply — all WARC bands and digital memory. Cat D-2871.

WAS ~~$1328~~

ONLY $1225

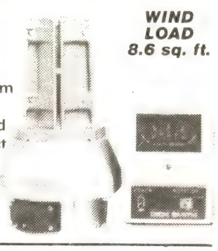
NEW

VHF — UHF Whip with base

68-600 MHz comes with cutting chart. 110cm long stainless steel super for UHF CB & 2m amateur & 70 cm amateur & our new scanners. Cat D-4023

ONLY $9.95

ANTENNA ROTATOR



WIND LOAD 8.6 sq. ft.

with control box.
Rotation torque: 500kgcm
Braking torque; 1500 kgcm. For VHF/UHF and small HF beams - perfect for TH 3JR (above). Cat D-5000

$139

FT 290 R 2m

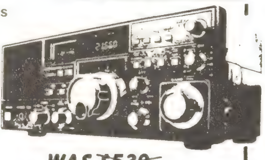
SAVE OVER $40!

All mode — scanning, portable plus LCD plus 2 VFO's plus 10 memories plus hi/lo power plus built in antenna plus NB plus memory backup. Cat D-2885

and it's only $349 WAS ~~$395~~

FRG 7700 HF RECEIVER

SAVE OVER $10!



150KHz - 30MHz
Go anywhere — all mode — short wave listeners dream come true! Cat D-2840

ONLY $525

WAS ~~$539~~

FL 2050 2m linear

Cat D-2547

70 watts output for 10 watts input. Great for mobile 13.8V operation. Perfect with our FT 480R and hand helds.

only $239

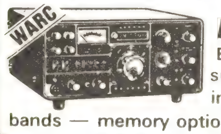
FL 2100Z HF Linear

Big power — 1.2kW. All WARC bands. Cat D-2548.

SAVE $12! WAS ~~$580~~ **$568**

THAT'S LESS THAN 48¢ PER WATT!

FT 902D



Built - in power supply, 180W PEP in all WARC bands — memory option Cat D-2853

ONLY $1195

The stores at right stock this complete list of Dick Smith Amateur Radio equipment. All other Dick Smith stores stock some amateur equipment but may not be able to give you the service of "Ham Shack" stores listed.

Sydney — 125 York St 290 3377
Gore Hill — 162 Pacific Hwy 439 5311
North Ryde — 396 Lane Cove Rd 888 3200
Parramatta — 30 Grose St 683 1133
Adelaide — 60 Wright St 212 1962

Springvale — Dandenong Rd 547 0522
Richmond — 656 Bridge Rd 428 1614
Perth — 414 William St 328 6944
Buranda — 166 Logan Rd 391 6233
Chermside — 842 Gympie Rd 59 6255
Melbourne — 399 Lonsdale St 67 9834

DSE/A307/PAI

JAYCAR–for hard to get * Semiconductors *

WE NOW STOCK HUNDREDS MORE IC's THAN MOST OF OUR COMPETITORS AT THE BEST PRICES AROUND

CMOS

4000	Dual 3 Input NOR Gate	40
4001	Quad 2 Input NOR Gate	35
4002	Dual 4 Input NOR Gate	48
4006	18 Stage Static Shift Register	40
4007	Dual Complimentary Pair Plus Inverter	38
4008	4-Bit Full Adder	95
4009	Hex Buffer (Inverting)	$1 10
4010	Hex Buffer (Non-Inverting)	90
4011	Quad 2 Input NAND Gate	35
4012	Dual 4 Input NAND Gate	20
4013	Dual D Flip Flop	90
4014	8-Stage Static Shift Register	$1.00
4015	Dual 4-Bit Static Register	95
4016	Quad Analog Switch	50
4017	Decade Counter/Divider	$1.20
4018	Resettable Divide-by-N	50
4019	Quad AND OR Select Gate	75
4020	14-Stage Binary Counter/Divider	$1.45
4022	Divide-by-8 Counter Divider	$1.25
4023	Triple-3-Input NAND Gate	28
4024	7 Stage Binary Counter/Divider	$1.18
4025	Triple-3-Input NOR Gate	35
4026	Decade Counter-7-Seg Output	$2.20
4027	Dual JK Flip Flop	90
4028	BCD-to-Decimal Decoder	$1.18
4029	Presettable Up-Down Counter	$1.25
4030	Quad 2 Input EXCLUSIVE OR Gate	80
4031	64 Stage Static Shift Register	$2.20
4032	Triple Serial Adder	$1.95
4034	8 Stage TRI STATE Universal BUS Register	$2.95
4035	4 Bit Shift Register	50
4038	Triple Serial Adder (Negative Logic)	$1.95
4040	12 Stage Binary Counter	$1.65
4042	Quad Clocked D Latch	70
4046	Micropower Phase-Lock Loop	$1.55
4047	Low Power Mono/Astable Multi	$1.75
4049	Hex Inverting Buffer	75
4050	Hex Buffer (Non-Inverting)	60
4051	8 Channel Analog Multiplexer	95
4053	Triple 2 Channel Analog Multiplexer	$1.75
4055		50
4066	Quad Analog Switch	80
4067	1-of-16 Analog Switch	$2.95
4068	8 Input NAND Gate	48
4069	Hex Inverter	70
4070	Quad 2 Input EXCLUSIVE OR Gate	48
4071	Quad 2 Input OR Gate	48
4073	Triple 3 Input AND Gate	65
4075	Triple 3 Input OR Gate	60
4076	Quad D Flip Flop	$1.25
4077	Quad EXCLUSIVE NOR Gate	50
4078	8-Input NOR Gate	65
4081	2-Input AND Gate	60
4093	Quad 2-Input NAND Schmitt Trigger	80
4411		$17.75
4426	Decade Counter 7 Seg Output	$2.20
4500		$2.50
4501	Triple Gate	$1.95
4502	Strobed Hex Inverter	$1.95
4503	Hex 3 Stage Buffer (Non Inverting)	95
4508	Dual 4-Bit Latch	$5.00
4511	BCD to 7 Seg Decoder/Driver	$1.50
4512	8 Channel Data Selector	$1.25
4514	4 to 16 Line Decoder/4 Bit Latched	$2.50
4517	Dual 64 Bit Static Shift Register	$1.95
4518	BCD Up Counter	$1.50
4520	Dual Binarv Up Counter	$1.50
4526	ProgrammaLie 4-Bit Binary Counter	$1.50
4528	Dual Mono Multi	$1.25
4538	Dual Mono/Precision Multi	$2.65
4543	BCD to 7 Seg Latch/Decoder/Driver/LCD	$1.95
4553	3 Digit BCD Counter	$6.50
4557	1 to 64 Bit Variable-Length Shift Register	$3.50
4581	4 Bit	$3.50
4582	Look Ahead Carry Block	$2.50
4584	Hex Schmitt Trigger	$1.65
74C02	Quad 2 Input NOR Gate	50
74C04	Hex Inverter	55
74C14/40106	Hex Schmitt Trigger	$1.50
74C922	16 Keyboard Encoder	$9.50

74LS TTL

74LS00	Quad 2 Input NAND Gate	35
74LS01	Quad 2 Input NOR Gate	40
74LS02	Quad 2 Input NOR Gate	40
74LS03	Quad 2 Input NAND Gate (oc)	60
74LS04	Hex Inverter	40
74LS05	Hex Inverter (oc)	60
74LS08	Quad 2 Input AND Gate	40
74LS09	Quad 2 Input AND Gate (oc)	50
74LS10	Triple 3 Input NAND Gate	40
74LS11	Triple 3 Input AND Gate	40
74LS12	Triple 3 Input NAND Gate (oc)	60
74LS13	Dual NAND Schmitt Trigger	60
74LS14	Hex Schmitt Trigger	85
74LS20	Dual 4 Input NAND Gate	40
74LS21	Dual 4 Input AND Gate	35
74LS27	Triple 3 Input NOR Gate	60
74LS30	8 Input NAND Gate	50
74LS32	Quad 2 Input OR Gate	45
74LS33	Quad 2 Input NOR Gate (oc)	50
74LS42	1 of 10 Decoder	95
74LS47	BCD to 7 Seg Decoder/Driver (oc)	$1.45
74LS48	BCD to 7 Seg Decoder/Driver	$2.95
74LS49	BCD to 7 Seg Decoder/Driver	$1.95
74LS73	Dual JK Flip Flop with Clear	95
74LS74	Dual D Flip Flop with Preset & Clear	75
74LS75	4 Bit Bistable Latch	65
74LS76	Dual JK Flip Flop	60
74LS78	Dual JK Flip Flop	60
74LS83	4 Bit Full Adder	$1.00
74LS85	4 Bit Magnitude Comparator	$1.25
74LS86	Quad 2 Input EXCLUSIVE OR Gate	50
74LS90	Decade Counter	75
74LS92	Divide by 12 Counter	$1.25
74LS93	4 Bit Binary Counter	85
74LS95	4 Bit Shift Register	75
74LS107	Dual JK Flip Flop	55
74LS109	Dual JK Edge-Triggered Flip Flop	75
74LS112	Dual JK Edge-Triggered Flip Flop	60
74LS122	Retrig Monostable with Clear	75
74LS123	Dual Retrig Mono with Clear	$1.10
74LS125	Quad BUS Buffer Tri-State (lo enable)	55
74LS126	Quad BUS Buffer Tri-State (hi enable)	75
74LS138	1-of-8 Bit Decoder/Multiplexer	92
74LS139	Dual 2 to 4 Line Decoder/Multiplexer	$1.45
74LS147	10 Line dec to 4 Line Priority Encoder	$2.95
74LS148	8 Line to 3 Line Priority Encoder	$3.95
74LS151	1 of 8 Selector/Multiplexer	75
74LS153	Dual 4 Line to 1 Line Selector/M'plexer	75
74LS155	Dual 1 of 4 Decoder	$1.00
74LS156	Dual 1 of 4 Decoder (oc)	$1.00
74LS157	Quad 2 Input Multiplexer (Non-Inverting)	$1.50
74LS158	Quad 2 Input Multiplexer (Inverting)	79
74LS160	BCD Decade Counter Asynch. Reset	95
74LS161	4-Bit Binary Counter Asynch. Reset	95
74LS162	BCD Decade Counter Synchron. Reset	$1.00
74LS163	4-Bit Binary Counter Synchron. Reset	$1.20
74LS164	8-Bit Shift Register	$1.20
74LS165	Parallel Load 8-Bit Shift Register	60
74LS166	8-Bit PISO Shift Register	$2.95
74LS173	4-Bit D Type Register	95
74LS175	Quad D Type Flip Flop	$1.65
74LS190	Up/Down Decade Counter	$1.25
74LS191	Up/Down Binary Counter	$1.15
74LS192	Up/Down Decade Counter Dual Clock	95
74LS193	Up/Down Binary Counter Dual Clock	$1.65
74LS194	4-Bit Left-Right Shift Register	95
74LS195	4-Bit Parallel Access Shift Register	$5.00
74LS221	Dual Monostable Multivibrator	$2.25
74LS240	Octal Tri-State Driver	$3.50
74LS241	Octal Tri-State Driver	$3.50
74LS244	Octal Buffer/Driver	$3.55
74LS245	Octal Bus Transceiver	$2.95
74LS257	Quad 2 Input Multiplexer Tri-State	85
74LS258	Quad 2 Input Multiplexer Tri-State	75
74LS259	8 Bit Addressable Latch	$2.50
74LS266	Quad EXCLUSIVE NOR Gate (oc)	$1.25
74LS273	Octal D Type Flip Flop	$2.95
74LS365	Hex Buffer with Common Enable	60
74LS366	Hex Inverter with Common Enable	60
74LS367	Hex Buffer 4 Bit and 2 Bit	$1.25
74LS368	Hex Inverter 4 Bit and 2 Bit	70
74LS373	Octal Transparent Latch	$2.95
74LS374	Octal D Type Flip Flop	$2.50
74LS393	Dual LS93	$3.50

MEMORIES

		1-9	10 up
2102	1K x 1 RAM	$1.95	$1.65
2114-3	1K x 4 RAM 350nS	$2.45	$2.00
2114	1K x 4 RAM 450nS	$1.45	99
4116	16K x 1 Dynamic RAM 250nS	$2.50	$2.00
6116	2K x 8 CMOS RAM	$12.50	$9.90
2708	1K x 8 EPROM	$7.95	
2716	2K x 8 EPROM (Single +5V)	$6.50	
2532	4K x 8 EPROM (Single +5V)	$14.95	
2564	8K x 8 EPROM (Single +5V)	$35.00	

Z-80A/6800

Z-80A	CPU 4MHz	$8.50
Z-80A	PIO 4MHz	$8.50
Z-80A	CTC 4MHz	$8.50
Z-80A	S10/0 4MHz	$20.95
Z-80A	S10/1 4MHz	$20.95
Z-80A	S10/2 4MHz	$20.95
Z-80A	DART 4MHz	$32.95
Z-80A	DMA 4MHz	$20.95
6802	CPU	$11.00
6821	PIA	$4.95

SUPPORT

8255	PPI	$9.95
5303	UART	$12.95
1771	Floppy Disk Controller	$19.95
1488	RS232 Quad Line Driver	$1.50
1489	RS232 Quad Receiver	$1.50
8131	6-Bit Comparator (Negative Out)	$4.95
81LS97	Octal Buffer	$2.35
81LS98	Octal Buffer (Inverting)	$2.35

SPEECH SYNTHESISER

DT1050 National Digitalker Processor & ROM Set	$95.00
DT1057 National Digitalker Second ROM Set	$69.00

Send SAE for more details. NOTE new low price. Data sheets included in chip sets.

LINEAR DEVICES

ZN414	$2.50	LM381N	$3.95
TL061	$2.45	LM381AN	$5.95
TL062	$2.45	LM382	$2.60
TL064	$4.75	LM394CH	$5.95
TL071	98	NE555	35
TL072	$1.45	LM7555	$1.95
TL074	$3.50	LM556	$1.10
TL075	$3.50	LM567	$1.95
TL081	65	LM570	$7.50
TL082	95	NE571	$6.50
TL084	$2.95	LM723	$1.45
TL085	$3.50	LM741	40
LM234	$3.50	LM747	$1.95
LM301	60	LM1496	$1.98
LM307	90	LM3046	$1.45
LM308	$1.25	LM3080	$1.30
LM311	95	LM3130	$1.80
LM319	$3.50	LM3140	$1.45
LM324	$1.20	LM3900	95
LM334	$2.50	LM3914	$6.50
LM339	95	LM3195	$4.50
LF347N	$3.50	LM39152	$12.50
LM348	$2.25	LM4136	$1.85
OM350	$9.50	LM4558	$1.50
LM361	$3.75	LM5534N	$1.55
LM380	$1.48	LM5534AN	$2.00

SPECIAL FUNCTION

SAB0600 Door Chime	$9.95
AY-1-5050	$9.50
TEA-1002 PAL Colour Encoder	$17.50
TDA-1022 Bucket Brigade	$29.50
EXAR 2206 Function Generator	$5.95
MOC-3020 TRIAC Opto Coupler	$2.50
MM 5837 Noise Generator	$3.90
TA 7205P Audio Amp	$4.50
7216 IJI Audio Amp	$47.50
SN 76488NF Sound Effects Generator	$5.95
AY-1-0212 Top Octeve Synthesiser	$19.50

VOLTAGE REGULATORS

7805 5V+ Regulator TO-220/amp	$1.05
7905 5V– Regulator TO-220/amp	$1.65
7812 12V+ Regulator TO-220/amp	$1.05
7912 12V– Regulator TO-220/amp	$1.65
7815 15V+ Regulator TO-220/amp	$1.05
7915 15V– Regulator TO-220/amp	$1.65
78L12	$1.00
78L15	$1.00
79L15	$1.00
LM323 3amp 5V TO-3	$1.50
LM309 1.5 amp 5V TO-3	$7.50
LM317T 2-30V adjustable 1 amp TO-220	$2.80
LM317KC 2-30V adjustable 3 amp TO-3	$6.50
LM318H	$3.50
LM337K	$9.50
LM396K	$19.50

LED's

5mm Red	15
5mm Green	26
5mm Yellow	30
5mm Orange	28
3mm Red	18
3mm Green	28
3mm Yellow	28
Rectangular Red	40
Rectangular Green	40
Rectangular Yellow	40
Flashing Red	49
Flashing Red 10+ each	45

New JAYCAR store opening next month at Carligford – right at Carlingford Court, next door to Kentucky Fried Chicken

DISCRETE DEVICES

VN88AF	$3.00	BC547	15
BCY71	95	BC548	15
JDT9203	$1.95	BC549	15
40411	$5.00	BC550	65
MJ15003	$4.75	BC556	65
MJ15004	$4.75	BC557	18
2SJ49(P)	$6.50	BC558	18
BDV64B	$5.95	BC559	18
BUX80	$9.50	BC639	34
2SK134(N)	$6.50	BC640	34
BU105	$12.50	BD266AD	$1.50
MPSA05	95	BD139	53
TIP31A&B	90	BD140	53
TIP32A	90	MJ2955	$1.50
TIP2955	$1.20	2N3055	$1.50
TIP3055	$1.20	2N3442	$2.50
MPF102	95	2N3569	45
MPF105/2N5459	85	2N3638	35
MPF106/2N5485	78	2N3643	45
MPSA55	95	2N3645	45
MFE131	$1.98	2N3773	$5.00
BF115	75	2N4258	35
BF200	95	2N5484	85
BF469	$1.65	2N5087	65
BF470	$1.65	2N5589	$8.50
MJE340	$1.98	2N5590	$9.50
MJE350	$1.98	2N5591	$12.50
ZTX501	45	2N5245	90
BC337	25	2N6027/D13T1	58
BC546	65	TT800	85

IC SOCKETS – SOLDER

8 Pin	25
14 Pin	30
16 Pin	35
18 Pin	35
20 Pin	38
22 Pin	40
24 Pin	50
28 Pin	60
40 Pin	70

QUALITY WIRE WRAP IC SOCKETS

14 Pin	85
16 Pin	$1.05
18 Pin	$1.35
20 Pin	$1.45
22 Pin	$1.40
24 Pin	$1.75
28 Pin	$2.25
40 Pin	$2.65

Ideal for projects

DIL PLUGS AND COVERS SOLDER TYPE

14 Pin Plug	85
14 Pin Cover	25
16 Pin Plug	95
16 Pin Cover	25
24 Pin Plug Only	$2.50

TOP QUALITY

CRYSTALS

Case Style: HC-33/U	
1.000MHz	$12.50
1.8432MHz	$9.50
2.000MHz	$7.50
3.000MHz	$7.50
Case Style: HC-18/U	
4.000MHz	$6.50
4.43MHz	$6.50
4.9152MHz	$6.50
5.000MHz	$5.50
8.867238MHz	$5.50
10.000MHz Parallel Resonant	$9.50
12.000MHz	$5.50
16.000MHz	$5.50
20.000MHz	$7.50

The right crystal at the right PRICE

Jaycar

NEW SHOP HOURS
Mon- Fri 8.30 to 5.30pm
Sat 8.30 to 12.00pm
Thurs night to 8.30pm

125 YORK ST SYDNEY 2000
Ph. 2646688 Telex 72293
Mail Orders To:
Box K-39 Haymarket 2000
Post and Packing charges
$5-$9.99 ($1.20) $10-$24.99 ($2.40)
$25-$49.99 ($3.50) $50-$99.99 ($4.60)
$100 up ($6.20)

E & OE

New single board Cromenco computer

Adaptive Electronics Pty Ltd, Australian distributors of Cromenco Inc computer products, now has available a powerful new personal computer system, billed as "more than just a sophisticated home computer".

The Cromenco C-10, the least expensive of the new systems, is based on the Z80A microprocessor and comes with 64K of programmable memory and 16K of internal ROM. An integral built-in high resolution 30cm video monitor and a detachable keyboard are included in the price (stated as $US995).

Also offered is the C-10SP, or "Super Pack". This system consists of the basic C-10, keyboard and a 14cm floppy disk drive providing 390K of storage. It comes with the CP/M operating system, Cromenco's Structured Basic, word processing and financial spreadsheet software. Total price is $US1785, including the software.

Peripherals available include additional floppy disk drives and a new low cost daisywheel printer.

Adaptive Electronics' Marketing Manager, Adam Gatt, sees the Cromenco C-10 as "perfect for the serious personal computer user, the executive work station, for distributed data processing or as a front end for a mainframe computer".

Additional information is available from Adaptive Electronics Pty Ltd, 418 St Kilda Rd, Melbourne, Vic 3004.

Temperature sensors for catering industry

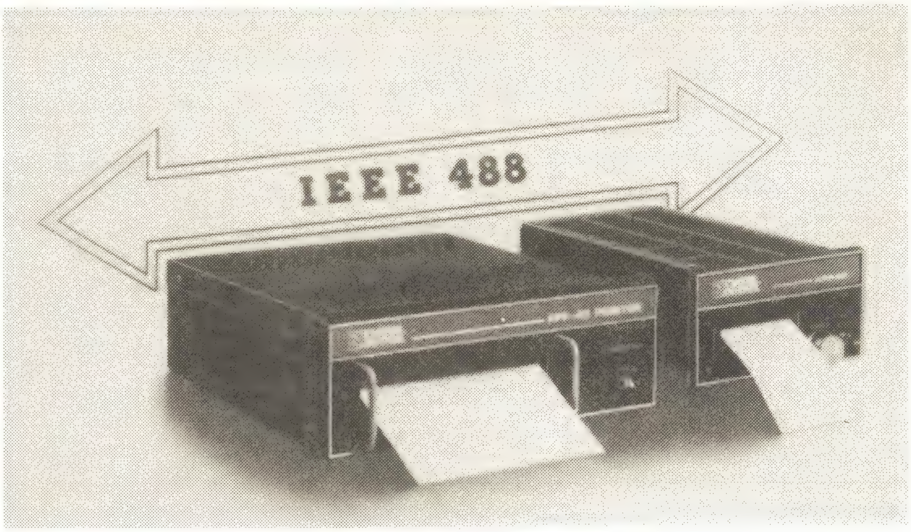
An English manufacturer, Mathey Printed Products Ltd, are marketing a temperature sensor under the trade name Thermafilm. Thermafilm detectors are thick film, platinum resistance, devices which can be used for accurate temperature measurement over the range −70°C to +600°C.

Mathey Printed Products has announced the availability of an application note which describes the use of the sensors in a high temperature probe designed for deep fat fryers used by the catering industries.

The fast response temperature probe acts as a temperature control and warning device for the cooking equipment.

The application note is free on request to the company at William Clowes St, Burslem, Stoke-on-Trent, ST6 3AT, England.

Miniature printers for IEEE-488 bus



Elmeasco Instruments Pty Ltd now has available a range of miniature thermal printers from Datel-Intersil of the United States. The big advantage of the printers is that they are compatible with the Hewlett-Packard IEEE-488 General Purpose Interface Bus (GPIB), an interconnection standard widely used in laboratory instrumentation and industrial control.

Two versions of the alphanumeric printers are available; the APP-48A3 for 48-column printouts, and the APP-20A3 which prints 20 characters to a line. Both are available with a stand for tabletop use or for panel mounting.

The printers are said to be ideal for recording the output of other IEEE-488 compatible instruments such as process control monitors, industrial and laboratory data loggers, automated test equipment, security systems and data communications loggers.

The APP-20 measures just 113mm x 69mm x 222mm, and the APP-48 is 206mm x 72mm x 211mm. Both printers use thermal paper.

For more information contact Elmeasco Instruments Pty Ltd, PO Box 30, Concord, NSW 2137.

Arlec-Soanar Electronics expands operations

A success story which began 37 years ago was acknowledged in a ceremony performed by the Federal Member for Chisolm, Mr Graham M. Harris, in May. The Mayor of Box Hill (Victoria) and leading electronics industry figures were among the guests at a function to celebrate the opening of new administration, sales, marketing and engineering office extensions of the Australian owned electronics manufacturing company Arlec Pty Ltd.

After the opening ceremony guests took part in an inspection of the Arlec factories in Lexton Road, Box Hill.

Arlec commenced business in 1945, specialising in electronic equipment and transformer manufacture, with a staff of two. Company growth continued over the next decade as Arlec consolidated its position as a manufacturer of transformers, power supplies and electronic products.

In 1950 the company moved to larger premises, its second move since 1945.

In 1963 an associate company, Soanar Electronics Pty Ltd was formed to import and distribute electronic components. Soanar has since become one of the largest suppliers of electronic components in Australia.

Just part of Arlec's product range.

In 1973 Arlec commenced manufacture and marketing of consumer electronic products under their own brand.

Total worldwide sales for the Arlec-Soanar group for 1981/82 were around $A17 million.

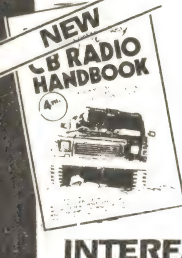
BOOKS... GOOD ENOUGH TO GO TO BED WITH!

TOWERS' INT. TRANSISTOR SELECTOR

If you deal with transistors this book can help you. It offers information on ratings, characteristics, terminal identification and substitution equivalent and more. Cat B-1826.

.... **ONLY $19.95**

NEW



DICK SMITH'S AUST'N CB HANDBOOK

Sensational best seller! Everything you want to know about CB! What to buy, what to say on air, what to expect from your CB, plus lots more. Even includes a section on the UHF CB scene. Cat B-2325

.... **ONLY $4.95**

INTERFACING THE S-100

This fantastic book helps the S-100 Bus users expand the utility and power of their systems to achieve maximum results possible. Don't miss out at this low price!

Cat B-2341 .... **ONLY $16.00**

PROGRAMMING THE Z-80

Designed as an educational text and a self contained reference manual, this book presents a thorough introduction to machine language programming, with illustrations and programs. Great value! Cat B-2364

ONLY $10.95

NEW

DICK SMITH'S AUSTRALIAN AMATEUR
BRAND NEW RE-WRITTEN 1982 EDITION!

DICK SMITH'S AMATEUR RADIO HANDBOOK

Beginners and novices alike will benefit greatly from the wealth of information contained for the first time between two covers. Increase your enjoyment of amateur radio.

Cat B-2320 ... **ONLY $6.95**

T/X CROSS REFERENCE GUIDE

Find out what replaces what with this handy cross reference guide. Thousands of transistors listed. Cat B-4506

.... **ONLY $3.25**

OVER 20,000 SOLD!

FUN WAY VOL.1

72 PAGES, 4TH PRINTING! For the raw beginner, this top selling book has 20 exciting projects that prove electronics can be fun. Build a beer powered radio, an electronic siren and lots more. Cat B-2600

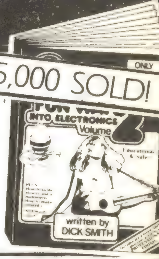
.... **ONLY $4.95**

FUN WAY VOL 2

OVER 25,000 SOLD!

130 PAGES, 3RD PRINTING. 20 more exciting projects from a mosquito repeller to a home intercom and lots more. All projects are battery powered. Cat B-2605 ....

.... **ONLY $6.95**



DICK SMITH'S COMPUTERS FOR KIDS

Start them off the right way!

A basic programming manual written just for kids! Written by an experienced teacher it talks in a language the kids can understand. Why not give them a head start...! Cat B-6190

$4.95

TRANSISTOR SPECS MANUAL

Want to find out the specs of a transistor for replacement or any other purpose? This manual will tell you. Thousands of entries. Cat B-4508

.... **ONLY $6.50**

GIANT HANDBOOK ELEC. CCTS

Over 800 pages containing unlimited information on electronic circuits for practically every application.

Cat B-1780 .... **ONLY $18.95**

1982 RADIO AMATEURS HANDBOOK

59TH EDITION

Published by the American Radio League, this book covers everything from who are 'hams', to wave propagation.

Cat B-2219 .... **ONLY $19.95**

COMPLETE MICROCOMPUTER SYSTEMS HANDBOOK

A complete guide to microcomputers Cat B-1872

.... **ONLY $12.90**

104 EASY T/X PROJECTS

A serving of easy, relatively inexpensive projects covering all fields of electronics.

Cat B-1620 .... **ONLY $9.50**

GETTING TO KNOW PERSONAL COMPUTERS

This great book takes the mystery out of computers. In easy to read language, it makes a fantastic beginners guide

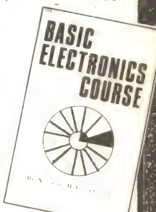
Cat B-2350 .... **$6.95**

BASIC COMPUTER GAMES

101 great, fun games to play on your home computer. Each game is complete with programming and sample run. Cat B-2351

.... **ONLY $11.45**

BASIC ELECTRONICS COURSE



A perfect reference guide and 'brush-up' guide for technicians, and for anyone who wants to advance their knowledge of electronics. Cat B-1689

only $11.75

A GREAT RANGE OF COOKBOOKS!

Ever wondered what to do with those boring old TTL's, CMOS's and IC's to make them more interesting? These books tells you what they are, how they work and the best way to use them. (Simply season to taste and simmer for one hour).

CMOS COOKBOOK Cat B-1248 ....

ONLY $13.50

TTL COOKBOOK Cat B-1246 ......

ONLY $15.50

IC COOKBOOK Cat B-1244........

.... **ONLY $15.50**

NEW COMP SOFTWARE

SUPER NOVA

(Cass. SYS 80 TRS 80)

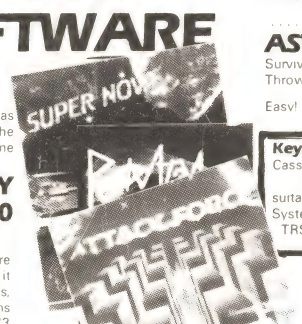
Destroy as many aliens & meteors as possible, but watch out for the 'Ragship'. Fast paced, real time game for one or two players.

Cat X-3663.......... **ONLY $24.50**

PENETRATOR

(Cass. SYS 80, TRS 80) If you are going to buy one game this year it must be this one. Superb graphics, rapid fire act. challenging situations and more. Don't miss out! Cat X-3673

ONLY $44.90



STOCK MARKET (Cass. SYS 80 TRS 80)

A valuable tool for the part time dabbler or for anyone with an interest in the stock market. Cat X-3768 ....

.... **and it's only $24.50**

ASTRO ATTACKER (Cass SORCERER)

Survive and destroy the Spinners, Laser Ships, Rockets, Flame Throwers and the Meteor Shower. Then dock with the mother ship.

Easy! Or is it? Cat X-3633 .... **ONLY $19.95**

Key:
Cass. SYS 80, TRS 80 on cassette, suitable for Dick Smith System 80, and Tandy TRS 80 computers.

ATTACK FORCE

(Cass SYS 80 TRS 80)

In this fast paced machine language game, 8 alien Ramships (the 'Crusher Convoy') are warping toward your ship. Dodge and destroy is your only hope. But it's not as easy as it looks.

Cat X-3662 .... **ONLY $24.50**

CPM 2.2 (Disk, SORCERER)

Complete Sorcerer software package for business and pleasure.

Cat X-3717 .... **FOR JUST $250.00**

SYSTEM DISK MAILING

(Disk, SYS 80, TRS 80) Now you can store up to 450 names and addresses on a single drive (up to 650 on two drives), and generate mailing labels as often as you want. You can enquire, modify or delete them as you require. Great for subscription lists etc.

Cat X-3771 .... **ONLY $69.50**

PAYMASTER PAYROLL SYSTEM

(Disk, SYS 80, TRS 80) Small business owners can save time and money with this program. It can produce payslips, bank deposit advices, group certificates and more

Cat X-3769 .... **ONLY $299.00**

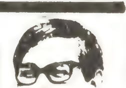
FEED BUDGET MANAGEMENT PROGRAM (Cass. SYS 80, TRS 80)

Dairy farmers - increase your production with this program. Use it to calculate everything involved in the preparation of a feed budget.

Cat X-3770 .... **ONLY $58.50**

DICK SMITH ELECTRONICS

See Page 124 for address details



DSE/A237/PAI

New Products

Convenient storage in new hobbyist work bench

This work bench on wheels is designed for the hobbyist, with a double power point and ample storage for components and tools.

For the hobbyist whose working space is restricted, or must be shared with other domestic requirements, a new hobby desk just announced will have a particular appeal. The unit has been designed to meet the needs of hobbyists in many fields. The desk section comes in various bright coloured laminates, also available in woodgrain finishes.

The desk top slides open to provide access to tools, etc, underneath. There are 12 small and 8 medium sized bins within easy reach giving ample storage for many components. A double safety power point is provided on a panel in the centre of the desk. There is room on the panel for additional instrumentation if required. The trolley section is manufactured from heavy gauge tube, finished with hard wearing epoxy enamel and quality castors for easy mobility. This hobby desk makes an attractive piece of furniture and eliminates the need of "packing up" after a session of hobbying. Simply unplug the lead and wheel away into a spare area. Further information from Jaylam Products Pty Ltd, 31 Nelson Street, Moorabbin 3189.

Datascape International has Anadex printers

Datascape International Pty Ltd has released a new range of Anadex "Silent/Scribe" dot matrix impact printers in Australia. The new range places a major emphasis on quiet operation, with all three new printers designed to operate at less than 55dBA at a distance of one metre.

Top of the range is the 9620A, a receive only printer designed for multiple applications in the office. As a standard alphanumeric printer it can print from 200 characters per second at 10 characters per inch, to 164cps at 16.4cpi. As a graphics printer it is dot addressable, with a horizontal and vertical resolution of 72 dots per inch. In a third mode it can print "letter quality" characters using a 13 × 9 dot matrix at 100cps.

The 9620A is available with tractor feed only. Features include up to 15 horizontal tab stops, in line character font changes, and standard serial communication protocols. Both Centronics parallel and RS-232C serial interfaces are available.

The DP9000A and DP9500A are new versions of established Anadex printers. They both include a heavy duty stepper motor for handling heavier paper, a 2.7k byte print buffer and front access to the DIP switches which control form length, line width default, alternate characters and serial protocols.

Noise reduction for all three printers is obtained by a new case design and special sound absorbent foam lining.

For further information contact Datascape International Pty Ltd, PO Box 579, Neutral Bay Junction, NSW 2089.

A hard disk for the Apple III

A new mass-storage system that increases the on-line storage capacity of Apple III personal computers nearly 35 times is now available in Australia.

The new Apple III ProFile Personal mass-storage system is a self-contained unit featuring an intelligent controller, a 14cm Winchester type hard disk drive, power supply, interface board and driver software. It increases the Apple III's storage capacity to five megabytes, enabling users to store on a single disk data that would normally occupy 35 14cm floppy disks.

An Apple-designed controller allows accessing of data at nearly ten times the speed of conventional floppy disk drives. Seven new programs have been developed to take advantage of the expanded capabilities of the Apple III/ProFile system. They are Apple III Pascal, Apple Business Basic, Visicalc (TM) III, Applewriter III, Access III, Script III and Business Graphics III.

ProFile can be used with any Apple III with 128K bytes of RAM and the Apple III's new operating system software, called Sophisicated Operating System 1.1.

For more information contact your local Apple distributor or Electronic Concepts Pty Ltd, 55-57 Wentworth Ave, Sydney, 2000.

SILVERTONE NEWS
Newsletter of Silvertone Electronics
Specialists in Radio Control

Radio Remote Control

CUSTOM MADE, HI SECURITY, LOW POWER RADIO CONTROL UNITS

IDEAL FOR THE RADIO REMOTE SWITCHING OF A MYRAID OF MECHANICAL DEVICES INCLUDING

- **Doors and Gates**
- **Lights**
- **Cameras**
- **Slipways**
- **Vehicles**

A FULL DIGITAL SYSTEM, BINARY CODED FOR MAXIMUM SECURITY WITH SWITCH SELECTABLE CODING

For details contact

SILVERTONE ELECTRONICS
6/2 SCHOFIELD STREET,
RIVERWOOD, NSW 2210
Phone 533 3517

6/2 Schofield Street, Riverwood, NSW 2210
Telephone: 533 3517

ELLISTRONICS P/L

289 LATROBE STREET, MELBOURNE 3000

PHONE: (03) 602 3499 TELEX: AA37758 LSTRON

TO GIVE YOU BETTER SERVICE WE HAVE INSTALLED A ROTARY LINE SWITCHBOARD NEW PHONE NO. 602 3499 WHICH TOGETHER WITH OUR 24 HOUR TELEX SYSTEM AND GREAT NEW DIRECT DISTRIBUTOR AGENCIES PLUS HUGE STOCK INVENTORY ALL ADD UP TO BETTER SERVICE AT LOWEST POSSIBLE PRICES. CHECK THE EXAMPLES SHOWN.

Direct factory authorised distributors for

FAIRCHILD
OK MACHINE AND TOOL CORP
T. B. ANSLEY
WELLER
XCELITE
ELCAP SEMICONDUCTORS
PECO SEMICONDUCTORS
RECTRON SEMICONDUCTORS

PART NO.	100+	1000+
4116-150ns LP	1.30	1.10
2114-200ns LP	1.30	1.10
BUX80	2.15	1.98
BD139	.25	.22
BD140	.25	.22
BC547/8/9	.06	.05
BC557/8/9	.06	.05
FND500	.84	.75
5mm RED LED	.06	.05
3mm RED LED	.06	.05
LM317T	.92	.86
LM320T*	.49	.42
LM324	.40	.37
LM340T*	.40	.37
7805KC	.96	.90
LM339	.40	.37
1488N	.45	.39
1489N	.45	.39
DB25P	2.00	1.90
DB25S	2.95	2.85

*ALL STANDARD VOLTAGES

PRICES ARE PLUS SALES TAX

And we are sole Australian Distributors for **IZUMIYA, JAPAN'S LEADING PC ARTWORK SYSTEM.**

ELLISTRONICS LOGIC PROBES AND THE ELLISTRONICS BREADBOARD SYSTEM. (DEALER INQUIRIES INVITED)

New Products

Flex operating system for Color Computer

Flex (tm), the standard operating system for 6800 and 6809 microprocessor systems is now available for the Tandy TRS-80 Color Computer.

The ability to run Flex opens up a wide range of software for the Color Computer, including languages such as Pascal, Forth and C, business programs and games like Adventure.

Flex from Frank Hogg Laboratory Inc runs on the Color Computer using Tandy's disk controller, but supports single and double sided disks with up to 80 tracks per side. It implements a full keyboard with a control and escape keys, and allows a variety of different screen displays and text formats.

The catch is that you require 64K of memory to run Flex, and this requires a modification to the circuitry of the Color Computer and the use of 64K RAM chips. Of course, you'll still be able to run Color Basic and Extended Color Basic programs.

The Frank Hogg Laboratory package comes with an extensive manual which includes details of the circuit modifications which must be made to the Color Computer.

Flex for the Color Computer is available on a 14cm disk, with operating and installation manual from Paris Radio Electronics, 7A Burton St, Darlinghurst, Sydney, NSW, 2010.

New two metre portable transceiver

Standard Radio, the communications division of Marantz Japan Inc has released a new multi-mode two metre portable transceiver through its Australian distributors, GFS Electronic Imports.

Designated the C-58E, the new transceiver offers a choice of 4000 spot frequencies from 144 to 148MHz, a wide choice of channel steps (25kHz, 12.5kHz, 5kHz, 1kHz and 100Hz), five memory channels which store mode as well as frequency, and operation on CW, LSB, USB and FM.

Other features include liquid crystal display of frequency, operation from a built-in battery or external power source, repeater offset, memory or band scan function, and an RF output of 1W on FM and SSB.

The C-58E is supplied with a carry strap, antenna and microphone. Dimensions are 129mm × 52mm × 190mm.

For more information contact GFS Electronic Imports, 15 McKeon St Rd, Mitcham, Vic 3132.

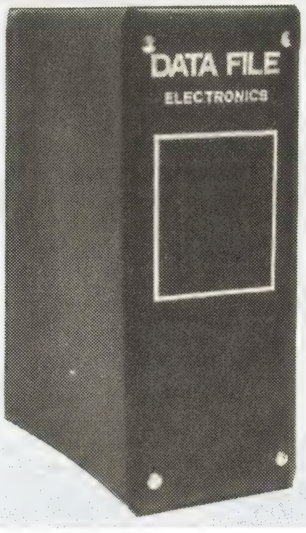
Magazine binders — quantity discounts

Altronics, of Perth, now has available magazine holders in durable vinyl. The holders measure 220mm × 292mm and provide convenient storage for up to 12 issues of popular standard size magazines.

Each magazine is secured in the binder by a separate wire rod which allows issues to be opened out flat for easy reference.

Those ordering quantities of the binders may choose their own lettering or company logo in place of the lettering shown. Recommended retail price of the binders is $5.90, but quantity discounts are available.

For more information contact Altronics Distributors Pty Ltd, PO Box 8280, Perth.



Arista public address and marine amplifiers

Arista Electronics Pty Ltd now has available a range of Public Address and marine amplifiers to suit all applications.

Top of the range is the Arista PS104L, a 50W RMS PA amplifier which can be powered from the mains or from a battery. For marine use the amplifier includes a built-in siren, fog-horn and four tone chime, while inputs include two adaptable high or low impedance microphone inputs with separate volume controls, two auxillary inputs and a cassette or radio input.

Output impedance is switch selectable from 4Ω, 8Ω, or 16Ω. The amplifier is supplied with mounting hardware and AC and DC power cords.

The Arista PS102M is an economy model 20W RMS public address amplifier with a built-in three station intercom, siren and fog-horn. It can be powered from a 12V-24V DC source with a power consumption of 60VA at maximum output. It is supplied with a dynamic microphone, mounting brackets and screws and a power cord.

Also avaliable are the Arista PS103L and the PS101M amplifiers, 20W RMS models with a range of features. The PS103L is an AC/DC unit with built-in siren and fog-horn, while the PS101M operates from DC only, and includes a four station intercom system and an illuminated output level meter.

Arista has all models in stock and ready to go. For more information contact the company at Area L-J, No.27, The Ultimo Centre, 39 Jones Street, Ultimo, NSW, 2007. Phone (02) 660-0500.

New range of DIP switches from Acme

A range of slide-operated DIP switches is now available from Acme Electronics. The "Series 78" switches feature a spring-loaded sliding ball contact system for high contact pressure and resistance to shock and vibration.

They are epoxy potted to prevent the entry of flux and cleaning solutions during automated assembly operations.

For further information contact Acme Electronics on (02) 648 2253, or (03) 729 6211.

Exhibition by US electronics manufacturers

The United States Department of Commerce and the Consulates General will hold an exhibition of catalogues from more than 100 US companies involved in electronic component and equipment industries this month.

Brochures on display will cover semi-conductor and integrated circuit production equipment, printed circuit board manufacturing gear, test equipment, active and passive components, switches, relays and connectors.

Technical representatives will also be on hand to answer any questions.

The exhibition will be held in four locations in Australia and New Zealand, opening at the Nelcon Trade Show, Wellington, NZ from August 24-26.

In Sydney the exhibition will be at the US Information Centre, 4 Cliff St, Milson's Point, August 26-27. From August 30-31 the display will be at the US Consulate, Perth, and from September 2-3 at the Southern Cross Hotel, Melbourne.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

DUKAS I ZINMAN: "Immaculate recording"

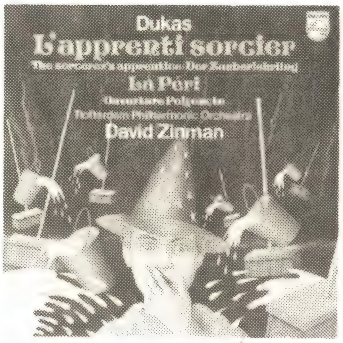
DUKAS — L'Apprenti Sorcier. Overture Polyeucte. La Peri. Rotterdam Symphony Orchestra conducted by David Zinman. Philips Analogue Stereo issued to its members by the World Record Club. 9500 833.

Back in 1965, when I was in Holland for the Music Festival, I heard a young, good-looking American conduct the Concertgebouw Chamber Orchestra in the absence of its principal, Simon Goldberg. As I remember, his program consisted of Haydn and other classics and I was so impressed by both his style and his rapport with a band consisting of players for the most part several years older than himself that, on my return to Sydney, I urged the ABC's music department to bring him to Australia for a tour. However nothing further came of it.

Zinman might even have been collecting a repertoire in one of the most eminent European music centres!

However, I am happy nowadays to see his name appearing more and more frequently in the music catalogue of records — at any rate the English one. That my estimate of his talents was justified is proved by the immaculate recording he has made of the music of Dukas. His repertoire has obviously expanded, for his program in Amsterdam was German 18th century, his recorded one under review, French. Moreover he was a French composer of the most exquisite order for, on his death bed, he destroyed much of his work he didn't like, leaving us only a handful of most exquisitely wrought sound.

This time, Zinman is conducting the Rotterdam Orchestra — still in Holland. His tempo in the only "pop" item on his program — L'Apprenti, Sorcier is just right — brisk but unhurried. The orchestra's playing is beyond praise — sharp attack and release, nuancing and phrasing in unassailable taste all recorded excellently by Philips using conventional analogue equipment. The balance is always perfect — repeat perfect.



The other two pieces might be new to many readers of this column. The Overture Poleucte was a very early Dukas work, showing more than a trace of Wagner's influence; enough to suggest the hand of Cesar Franck. Yet much of the Dukas elegance, orchestral and contents — is already showing itself. But it makes a good contrast between the incontrovertible French character of the other two pieces in the recital. Zinman — or Dukas — had not yet quite acquired true French sound though the climax to Poleucte is already mature Dukas.

I first heard La Peri danced by Pavlova as a solo at Drury Lane in London not long after World War I. The brass fanfare at the beginning was used as a prelude and Pavlova danced the rest.

Since then it has been recorded meagrely and not very well. Here one couldn't wish to hear it better handled. Zinman, to give it increased voluptuousness, takes it a little slower than usual, fills it with the subtlest of tiny nuances and, in general, makes it a meal for a voluptuary. I only wish the ABC would renew its offer to bring him here. (J.R.)

BRAHMS/BARENBOIM: "First class standard"

BRAHMS — Piano Concerto No 2 in B Flat. Daniel Barenboim (Piano) with the New York Philharmonic Orchestra conducted by Zubin Mehta. CBS Analogue Stereo SBR236038.

Soloist and conductor start this work conventionally although at the beginning, there is a little too much reverberation in the solo piano part. At any rate that is what I thought it was. By the time I'd finished playing the record I had decided that it was due to Barenboim's pedalling.

Mehta doesn't make much effort to thin out some of Brahms, grumous scoring. Here is good old solid Brahms, as thick as porridge. The two old friends play together as if they shared one mind. The style of both can best be described as masterful. And to add to their splendid reading the analogue sound is excellent, full of colour (Brahmsian) and flattering of solo orchestral musicians.

The performance of the second movement is full of subtleties, despite the movement's rugged cast of features. The violins sound ever so slightly wiry on my equipment. But it is still good and rumbustuous, helped by the perfect balance between soloist and orchestra.

The solo cellist (Lorne Munroe) begins her lovely statement a little modestly in the third movement but wins more expression as she goes on. Barenboim's piano part couldn't be played more poetically. Everything about it is elegant — the touch, dynamics, tempo, phrasing and nuancing. I have never heard it sound so lovely and it is one of Brahms loveliest melodies with the added merit of a piano entry quite unlike any other ever written.

You will find much to exhilarate you in the brilliant finale, mostly in the execution, since neither artist says anything new in the way of interpretation. Except for the exquisite slow movement, in which Baremboim plays such a peerless part, the exercise might best be described as a first class standard performance.

It is an analogue disc with a dynamic range ample but comfortable. Extreme delicacies are shared with formidable fffs. Enthusiastically recommended. (J.R.)

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

RACHMANINOV – Symphony No. 1 in D Minor. London Symphony Orchestra conducted by Andre Previn. World Record Quadrophonic OR 06360.

Is this symphony as bad as some people think? It is well known that it received a savage mauling form the critics at its first performance, but was that on account of the composition or the fact, as Rachmaninov alleged, that the conductor, Glazounov, was drunk? At any rate, its reception put the composer off from composing for three years. Rachmaninov did however himself disparage the work and put it out of his sight so that it was not discovered until 1944. It was composed in 1895.

Don't forget that the composer was only 22 when he wrote it, so don't listen to it for the first time expecting to find any of the long romantic melodies of the Piano Concertos. It is as serious minded as would befit a 22-year-old symphonist. What you will hear are fleeting memories of some of Rachmaninov's forbears – Tchaikovsky, Rimsky-Korsakov and others. It is by no means a great symphony but, considering the age of its composer, it shows more than usual student promise. There are some good tunes – a little short-winded perhaps.

The first movement is marked "grave" but Previn takes it a good deal faster than that – to its benefit in my opinion. Previn's second movement marked Allegro animato also translates the instructions into something much less animato. Although the analog sound is good, Rachmaninov's try at a big climax is underscored. Towards the end of the Third Movement, you hear something like one of Rachmaninov's long romantic themes but he wasn't up to handling this yet. Except for the Finale – which I thought easily the best movement – Previn takes the work a little offhandedly but finds plenty of well controlled vigor for the Finale.

In my opinion the symphony in no way lives up to the bad name it has acquired. I've heard plenty worse from eminent composers. (J.R.)

BARTOK CENTENARY

Five new recordings

BARTOK. Kossuth – Symphonic Poem. Four Pieces for Orchestra Op 12. The Budapest Symphony Orchestra and The Budapest Philharmonic Orchestra conducted by Arpad Joo. Digital stereo, Sefel Records SEFD-5005. [From P.C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.

Sefel is a new label, as far as I am concerned, originating from Sefel Records Ltd, Toronto, Ontario, Canada.

Chairman of the Company, Joseph Sefel, is of Hungarian nationality but resident in Canada. Realising that 1981 would be the centenary of the birth of his famous compatriot, composer Bela Bartok, he determined to bring out a special set of records by way of commemoration.

For the enterprise, he gained the services of Hungary's two leading orchestras and, as conductor, a young Hungarian Arpad Joo (pronounced You).

Arpad Joo was born in Hungary in 1948, attracted attention as a child pianist at age six and, as a student of the Zoltan Kondalay School of Music, gave his first public recital at age 12. After studying in Budapest, Austria and Rome, he emigrated to the USA for further study and ultimately moved to Canada as Director of the Calgary Philharmonic. He has been invited back to his native Hungary as a guest conductor.

There are five records in the present set, of which this one is the first. For your reference, the others are:

SEFD-5006: Suite No 1, Op 3 and Two portraits. (Budapest Symphony.)
SEFD 5007: Suite No. 2, Op 4 and Two Pictures. (Budapest Philharmonic)
SEFD-5008; The Miraculous Mandarin Concert Suite and Dance Suite. (Budapest Philharmonic.)
SEFD-5009: Concerto for Orchestra. (Budapest Symphony.)

Joo's survey in the five albums takes in nine orchestral scores that characterise Bartok's style from shortly after the turn of the century, when he was strongly under the musical influence of Richard Strauss, Liszt and Debussy. They take in his folk-influenced middle period and lead up to his subsequent renewal of creativity.

Kossuth-Symphonic Poem, composed in 1903, is not a well known work but, for those who may want to acquire it, the jacket notes contain Bartok's own outline of the emotions involved.

Four Pieces for Orchestra (1912) are also well covered in the notes, as are most other aspects of the disc.

Judging by the performance and standard of the disc, I would have high expectations of the complete set. Production was by well known British engineer Brian Culverhouse, using a Soundstream digital recorder. The pressings are on special Teldec vinyl, very clean and virtually noise-free.

But a word of caution about this first disc. You'll need a very quiet listening room if you are to follow the orchestra down into the muted passages. (W.N.W.)

BIZET: "great charm"

BIZET – L'Arlesienne Suite Nos. 1 and 2. Jeux D'Enfants. Toronto Symphony Orchestra conducted by Andrew Davis. Digital Recording. CBS 36713.

The name Davis shares type as big as that used for the composer on the sleeve of this digital disc. But on examination the first name is revealed to be Andrew, not Sir Colin. The orchestra, too, is the seldom recorded Toronto Symphony and, to my knowledge, this is the first recording by them I have ever heard.

Let me say, however, that the playing is nice and crisp and eminently suitable to the light character of the works played – good music of the lighter kind. Moreover, Andrew Davis – also a first time to my ears – conducts with considerable refinement and, moreover, shows complete knowledge of, and sympathy with, French style.

The disc comprises the two Arlesian Suites and Jeux D'Enfants, the last described by Bizet as a little suite for orchestra. What is not mentioned in the otherwise informative sleeve notes is that the last named was used by Diaghilev as music for a very successful short ballet called in English "Children's Tales".

The First Arelesienne Suite has survived assaults by cinema orchestras, accompaniment for silent films, palm court ensembles and similar types of popular entertainment – this over many years. It has not suffered unduly from this battering and still sounds good. Davis plays it very well indeed and, at one spot, achieves some daintiness over a counter theme that might well be the envy of a much more widely acclaimed orchestra. Only the last item, Carillon, sounds a little on the modest side.

The second Arlesienne Suite was cobbled together from neglected Bizet pieces found after the composer's death. Some were even re-orchestrated by French composer Earnest Guiraud. Guiraud was the man who wrote the music used, mostly in the past I am happy to say, to the recitatives in Bizet's Carmen. In most contemporary performances they are once again spoken and highlight the skill which motivated their inclusion by Bizet.

Davis conducts the whole disc with great charm and the light character of the music makes for perfect material for digital recording. The disc is altogether delightful light entertainment. (J.R.)

THIS IS SCOTLAND. One Hour Of Tartan Magic. Stereo, World Record Club R-09912.

Compiled originally as an EMI release (SCA 050) this might easily be described as a sampler of Scottish music for 1979 and 1980. Alternatively it could be regarded as a $6.99 musical tour of Scotland!

There are 18 tracks in all, playing for a full hour, with quite a few of the tracks being medleys — and with titles and artists much too numerous to list in detail. But they're all there in the jacket notes.

There are small groups like the Tommy McCulloch Trio playing Shetland reels, more from the Orkney Strathspey and Reel Society, and a jolly Lauder selection from the Party Singalongers. There's Jimmy Shand and his band, and so on, right through to "Mull Of Kintyre" by the Massed Bands, Pipes and Drums of the British Army, and Massed Bands of the Royal Artillery at the Edinburgh Military Tattoo.

Pipes are well in evidence, of course, but in the smaller groups, accordions, button accordions, fiddles and bass dominate the sound. It's not everybody's record but then it's not intended to be. It's for those with Scottish blood in their veins and maybe others who, like me, don't mind at all being whisked back for an hour to Edinburgh, the green hills of Perthshire, to Aberdeen and the Shetlands. (W.N.W.)

☆ ☆ ☆

THE VELVETEEN RABBIT, by Margery Willams, Narrated by John Le Mesurier. Music written, orchestrated and conducted by Ed Welch. Stereo, World Record Club WRC R-06188.

Based on Margery Williams' book of the same name, the contents to this album add up of a gentle fairy tale which should appeal to young children in an organised situation. The total playing time is about 40 minutes, including musical interludes, which suggests the possibility of using it as a "serial".

As the tale goes, the velveteen rabbit arrived at the nursery in a Christmas stocking and was the centre of attention for the little boy for about 10 minutes. After that, the rabbit was cast aside and would have been totally friendless had it not been for a dilapidated skin horse.

It was the same skin horse who told him that the only way he could ever understand the meaning of being real would be if someone began to love him. And that's what the boy began to do after Nanny pushed the velveteen rabbit into his bed one night to keep him company.

One day, however, the boy became sick with fever and the rabbit was discarded but it was not the end for him. The kind fairy who looks after much loved but worn-out nursery toys ......

John Le Mesurier recounts the tale in the manner of the nicest grandpop you've ever heard and, if I had any criticism of the disc at all, it would be that Ed Welch's music is just a bit too "grown up" for the story.

But there it is. Only you will know whether you have a place for a children's fairy tale. (W.N.W.)

☆ ☆ ☆

IMMORTAL CLASSICS — 25 Classical Favourites. World Record Club two-record set R 06303/4.

I don't know how the record companies decide on the content of records such as these, but few could say that they haven't heard the excerpts many times — music derived from opera, both comic and otherwise, plus musical set pieces that are so familiar.

The sound quality varies considerably, with some of the recordings dating back to the '50s. But the performances are probably among the best in the catalogue, involving many top artists, past and present.

So check your favourites against this selection: Trumpet Voluntary — Where e're You Walk — The Lass Of Richmond Hill — Fingal's Cave — Russlan And Ludmilla — O Divine Redeemer — The Flight Of The Bumble Bee — Espana — The Skater's Waltz — Vilja — You Are My Heart's Delight — Radetzky March — The Ride Of The Valkyries — Meditation From "Thais" — Rustle Of Spring — Pomp And Circumstance March.

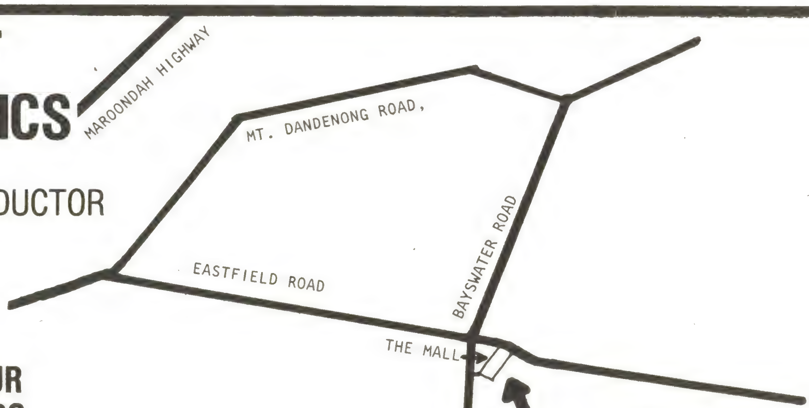
Some of the solo artists appearing are Kenneth McKellar, Robert Tear, Joseph Cooper, Joan Sutherland, Guiseppe di Stefano and Josef Sakonov, all backed by some of the best orchestras in the world. As is usual with WRC albums, helpul jacket notes are provided for those that need them.

In short, the set is by no means a hifi experience, but it could still bring a deal of pleasure to anyone with an ear for the contents. (N.J.M.)

TRUSCOTT ELECTRONICS

- ALL SEMICONDUCTOR COMPONENTS
- CAR HI-FI
- CB RADIO

IN FACT ALL YOUR ELECTRONIC NEEDS



SUPPLYING THE EASTERN SUBURBS WITH COMPETITIVE CITY PRICES AND SERVICE

TRUSCOTT ELECTRONICS
Cnr Eastfield and Bayswater Roads,
South Croydon 3136, Vic.
Phone (03) 723 3860.

LET ME SEE CLEARLY. Rose-Marie Longe. Stereo, Cornerstone CS-101. (From Cornerstone Records, Box 142, Mosman, NSW 2088.)

Reviewed out of sequence, "Let Me See Clearly" (CS-101) is an earlier recording than "I Can Be What I Am" (CS-102) reviewed in our March issue. Not surprisingly, the presentation of CS-102 is the more professional in detail. The photographs are better, the printing is better, the lyrics are provided in full and, the microphone system used for the recording has given a bit more roundness to the voice.

But those remarks notwithstanding, "Let Me See Clearly" is a sincere and well presented Gospel album. The diction is good and you should have no problems in following what the songs are all about: Faith Walkin' People — Part The Waters — Happiness Medley — What A Difference You've Made In My Life — Hymn — Giggle — Have Thine Own Way — All The Time In The World — Waters of Rest — Heaven Never Was Promised To Me.

Like CS-102, this CS-101 album had the benefit of an excellent line-up of musicians, acknowledged in the jacket notes and playing guitars, keyboards, trombone, tenor sax, woodwinds and percussion, with backing vocals provided by Kerry Biddell and friends. Production was by Steve Wyatt, and backing arrangements by Steve Wyatt and Tony Ansell, who also played keyboards.

The arrangements are modern and gently rhythmic but very easy on the ear and good family listening. (W.N.W.)

☆ ☆ ☆

SARA DANE, Don Burrows. Cherry Pie LD-37856. Festival Release.

The record cover goes to some pains to point out that this music has been inspired by the TV series, rather than being taken from the soundtrack. Perhaps it's just as well, as the style is definitely not colonial.

Apart from "Sara's Theme", which opens and closes the album, the music is very much a collection of old favourites, such as: In The Gloaming — Recuerdos — Drink To Me Only With Thine Eyes — Annie Laurie — Golden Summers — Londonderry Air — Last Rose Of Summer — Mull Of Kintyre — All Through The Night.

The treatment is fairly up tempo, with Londonderry Air in particular having been given the nearest thing to disco treatment that one could imagine. But, overall, the disc is most enjoyable, with Don Burrows' usual mastery of his usual collection of flutes of various types.

Digital mastering has given the disc a superb sound quality and Cherry Pie are to be congratulated on their efforts in the field. The other artists involved are: Mark Reily, drums; Phil Scorgie, electric bass; Jim Kelly, acoustic and electric guitar; Ian Bloxham, percussion; Julian Lee, electric and acoustic piano and synthesisers; Sam McNally, synthesisers. (NJM)

☆ ☆ ☆

DONOVAN, Neutronica. Interfusion L-37811. Festival Release.

Donovan makes no secret of his feelings about nuclear weapons and war in general, together with deterioration of the environment. Most of the tracks are fairly rocky in style, with eleven titles: Shipwreck — Only To Be Expected — Comin' To You — No Hunger — Neutron — Mee Mee I Love You — The Heights Of Alma — No Man's Land — We Are One — Madrigalinda — Harmony.

One can readily appreciate some of the feelings of despair and disgust at the present state of the world and some of the problems facing mankind, as expressed in these songs.

Donovan's backing group is small, with Jon Giblin on bass, Maurice Pert on drums, Ronnie Leahy on keyboards, Ian Berenson on electric guitar and Miller Anderson on lead guitar in 'We Are One'. Even if you do not always agree with his sentiments, the songs carry a positive message, (NJM).

☆ ☆ ☆

THE BUSHWACKERS COLLECTION. L-37821, Avenue Records. Festival release.

The 14 tracks on this record have been selected from five previous albums released by The Bushwackers Band over the period from 1976 to 1981 and some of the changes in style bear this out. With one exception — a track praising the virtues of Marijuana, which could be offensive — all the songs are typical of the Australian outback life, a lifestyle that is largely unknown to most city dwellers.

These are the titles you'll enjoy: Waltzing Matilda — Van Dieman's Land — Lachlan Tigers — The Flying Pieman — Theme from Ben Hall — Shores Of Botany Bay — Theme From Cash & Co — Hard Luck Stories — Billy Of Tea — Clancy Of The Overflow — Flash Jack From Gundagai — And The Band Played Waltzing Matilda.

This last song is a lament over the waste of life at Gallipoli in the first world war. The quality and performances are of a high standard throughout. (NJM)

AUSTRALIAN BROADCASTING COMMISSION

BROADCAST ENGINEERING OFFICERS

DARWIN

There are vacancies in the ABC's Darwin studios for Broadcast Engineering Officers.

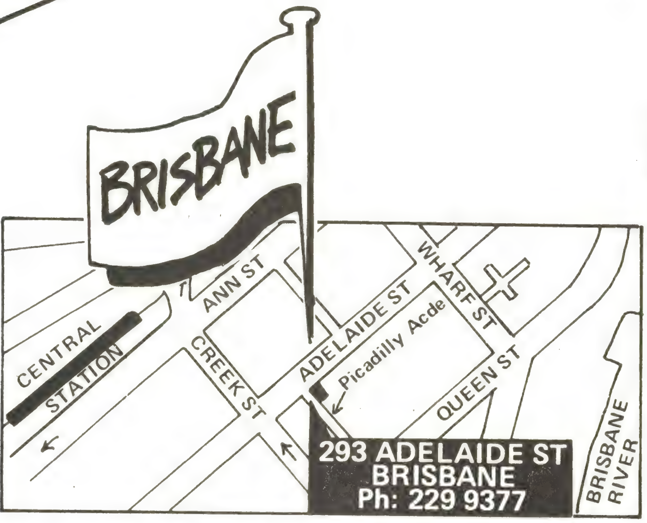
One (salary range $20,500-$21,500 p.a. + district allowance) will supervise staff responsible for the maintenance of all equipment associated with the Darwin station; investigate maintenance problems; ensure that the quality of radio and television signals is maintained; be the technical expert for the station; commission installations; be responsible for the use and maintenance of buildings and equipment; assist in training staff. Supervisory and administrative ability is essential.

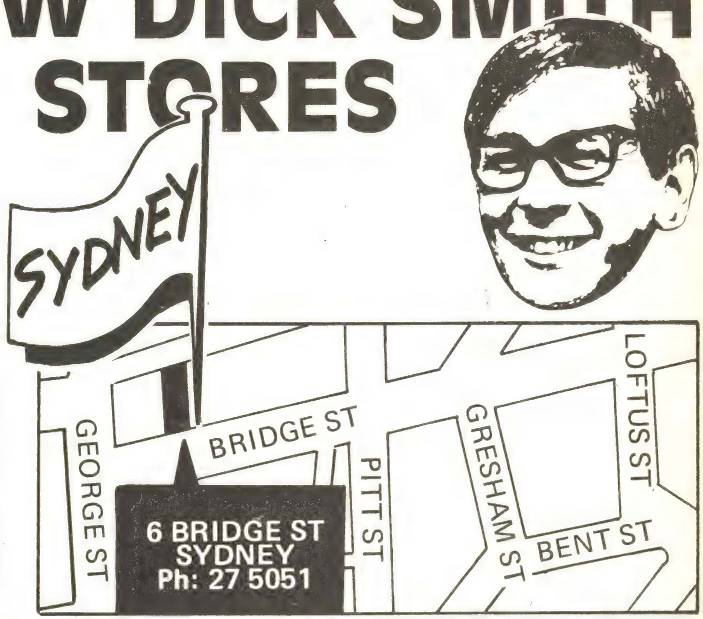
The other (salary $16,500-$18,500 p.a. + district allowance) will maintain and operate radio and television equipment, provide technical advice, guidance and direction for unforeseen problems on program changes and assist in training staff. A licence to drive a heavy vehicle is desirable.

Applicants must have the NSW Electronics and Communications Certificate or equivalent and the Television Operations Certificate of Proficiency or equivalent, with at least six years relevant experience in the operation and maintenance of electronic equipment and a knowledge of radio/television operational systems. Applications to Employment Officer (WS), ABC, GPO Box 487, Sydney, 2001. Mark envelope "Application – Confidential (EA)" and include details of qualifications and experience, telephone number and copies of two recent testimonials or the names of two referees. Applications close Monday, 6th September, 1982.

NOW 31 STORES ACROSS AUSTRALIA

WITH ANOTHER 2 NEW DICK SMITH STORES





DICK SMITH ELECTRONICS

STORE LOCATIONS

NSW	145 Parramatta Rd	AUBURN	648 0558
	T55 Terrace Level	BANKSTOWN SQ.	707 4888
	613 Princes Hwy	BLAKEHURST	546 7744
	552 Oxford St	BONDI JUNCTION	387 1444
	818 George St	BROADWAY	211 3777
	531 Pittwater Rd	BROOKVALE	93 0441
	147 Hume Hwy	CHULLORA	642 8922
	162 Pacific Hwy	GORE HILL	439 5311
	396 Lane Cove Rd	NORTH RYDE	888 3200
	30 Grose St	PARRAMATTA	683 1133
	6 Bridge St	SYDNEY	27 5051
	125 York St	SYDNEY	290 3377
	173 Maitland Rd	TIGHES HILL	61 1896
	263 Keira St	WOLLONGONG	28 3800
	Tamworth Acde & Kable Ave.	TAMWORTH	66 1961
ACT	96 Gladstone St	FYSHWICK	80 4944
VIC	399 Lonsdale St	MELBOURNE	67 9834
	260 Sydney Rd	COBURG	383 4455
	656 Bridge Rd	RICHMOND	428 1614
	Springvale & Dandenong Rds	SPRINGVALE	547 0522
	205 Melbourne Rd	GEELONG	78 6363
	Ross Smith Ave & Nepean Hwy	FRANKSTON	783 9144
QLD	293 Adelaide St	BRISBANE	229 9377
	166 Logan Rd	BURANDA	391 6233
	842 Gympie Rd	CHERMSIDE	59 6255
SA	60 Wright St	ADELAIDE	212 1962
	435 Main North Rd	ENFIELD	260 6088
	Main South & Flagstaff Rds	DARLINGTON	298 8977
WA	414 William St	PERTH	328 6944
	Wharf St & Albany Hwy	CANNINGTON	451 8666
TAS	25 Barrack St	HOBART	31 0800

MAIL ORDER CENTRE

PO BOX 321, NORTH RYDE NSW 2113

Telephone orders: (02) 888 3200

POST & PACKING CHARGES

ORDER VALUE	CHARGE	ORDER VALUE	CHARGE
$5.00 - $9.99	$1.40	$50.00 - $99.00	$4.60
$10.00 - $24.99	$2.40	$100.00 or more	$6.20
$25.00 - $49.99	$3.50		

Charges are for goods sent by post in Australia only – not airmail, overseas or road freight.

MAJOR RESELLERS

These are our major resellers. However we cannot guarantee they will have advertised items in stock or at the prices advertised.

Atherton QLD: Jue Sue's Radio Service, 55 Main St. 91 1208 ● **Bendigo VIC:** Sumner Electronics, 7 Edward St. 43 1977 ● **Ballina NSW:** A Cummings & Co. 91-93 River St 86 2285 ● **Broken Hill NSW:** Crystal TV Rentals, 166 Argent St. Ph: 6897 ● **Cairns QLD:** Thompson Instrument Services, 79-81 McLeod St. 51 2404 ● **Coffs Harbour NSW:** Coffs Harbour Electronics, 3 Coffs Plaza, Park Ave 52 5684 ● **Darwin NT:** Kent Electronics, 42 Stuart Hwy 81 4749 ● **Darwin NT:** Ventronics, 24-26 Kavanagh St ● **East Maitland NSW:** East Maitland Electronics, Cnr Laws & High Sts. 33 7327 ● **Geraldton WA:** KB Electronics & Marine, 361 Main Terrace 21 2176 ● **Gosford NSW:** Tomorrow Electronics, 68 William St 24 7246 ● **Kingston TAS:** Kingston Electronics, Channel Court, 29 6802 ● **Launceston TAS:** Advanced Electronics, 5a The Quadrant, 31 31 7075 ● **Lismore NSW:** Decro Electric, Magellan St & Bruxner Hwy, 21 4137 ● **Mackay QLD:** Stevens Electronics, 42 Victoria St 51 1723 ● **Maryborough QLD:** Keller Electronics, 218 Adelaide St. 21 4559 ● **Mt Gambier SA:** Hutcheson's Comm. 5 Elizabeth St 25 6404 ● **Mildura NSW:** McWilliam Electronics, 40 Lemon Ave, 23 6410 ● **Nambour QLD:** Nambour Electronics, Shop 4 Lowan House, Ann St. 41 1604 ● **Newcastle NSW:** Electron 2000, Shop 18, Hunter Shopping Village 26 2644 ● **Orange NSW:** M & W Electronics, 173 Summer St 62 6491 ● **Penrith NSW:** Acorn Electronics, Shop 12, 541 High St 36 1466 ● **Port Macquarie NSW:** Hall Of Electronics, 113 Horton St 83 5486 ● **Rockhampton QLD:** Purely Electronics, 15 East St 21 058 ● **Southport QLD:** Amateurs Paradise, 121 Nerang St 32 2644 ● **Tamworth NSW:** Sound Components, 111 Bridge St 32 9677 ● **Toowoomba QLD:** Hunts Electronics, 18 Neil St 32 9677 ● **Townsville QLD:** Tropical TV, 49 Fulham Rd, Vincent Village 79 1421 ● **Traralgon VIC:** Power 'n Sound, 147 Argyle St 74 3638 ● **Wagga NSW:** Wagga Wholesale Electronics, 82 Forsyth St ● **Wodonga VIC:** A & M Electronics, 78a High St 24 4588 ● **Whyalla SA:** Mellor Enterprise, Shop 2, Forsythe St 45 4764.

STORE HOURS

All Dick Smith stores are open from 9am to 5.30pm (Saturday 9am to 12 noon) except Queensland stores which open and close half hour earlier. Many stores are open for late night trading. Phone your nearest store for details.
Any terms offered are to approved applicants only.

Dear Customers,

Quite often, the products we advertise are so popular they run out within a few days. Or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!). Please don't blame the store manager or staff: they cannot solve a dock strike on the other side of the world, or fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give the store a call first ... just in case. Thanks.

Dick Smith & Staff

100% AND PROUD OF IT!

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

August 1932

Ten years old! The August 5, 1932 issue celebrated "Wireless Weekly's" 10th birthday, the first issue having appeared on August 4, 1922. The 1932 issue contained reproductions from the first issue, including instructions on how to build a loose coupler crystal set, and the front cover. The magazine also gave themselves a birthday present; a signal generator. Such an instrument was a real rarity in those days, outside the few design laboratories and factories.

There was also an article by Mrs C. R. Mackenzie, better known as Vera Wallace, who was one of the four cofounders of "Wireless Weekly". Mention of Mrs Mackenzie is particularly appropriate at this time because this grand old lady of the Australian radio industry, who was in her nineties, passed away only a few weeks before this August 1982 issue went to press.

☆ ☆ ☆

A hiker's radio: I notice that hiking is so popular in England that the radio papers there are describing the construction of compact battery portables, suitable for taking on the hike. There seems to be no limit to the application of radio, but from the little I know of hiking I am afraid I would rather tackle a 10-mile ramble over the hills without three heavy-duty "B" batteries over one shoulder, an accumulator hanging from the belt, a chassis in one hand and a loudspeaker in the other.

☆ ☆ ☆

What of the future? Will the superhet circuit last for three or four years like the TRF screen-grid job, or will it be superseded by something better? It does not seem possible to conjecture any startling alterations in design but much may depend on other factors.

RADIO 1/6 TELEVISION AND HOBBIES

August 1957

TV in medicine: Television continues to make rapid strides in the industrial and medical field. The development of colour TV has enormously increased the potential information which such systems can provide. The Walter Reed Army Hospital in Washington DC has installed (colour TV) equipment so that surgical work can be relayed to students and observers. Also, the largest dental college in the United States is using closed circuit television as a new teaching medium to speed instruction and keep abreast of the changing profession.

☆ ☆ ☆

Mount Blanc power: The famous glacier on Mount Blanc known to tourists as the Mer de Glace, is soon to be harnessed to provide hydro-electric power for France.

The scenic beauties of the region, however, will remain upspoiled, since all constructions are to be underground.

According to recently announced plans, the river flowing beneath the glacier will be tapped at an altitude of 4700 feet.

The water will be drawn off through a tunnel over a mile long to a point where high pressure pipes will carry it down a sharp drop of some 1200 feet to an underground power station in the valley of Chamonix.

Electric power produced through this scheme is expected eventually to reach hundreds of millions of kilowatts a year.

☆ ☆ ☆

Radio telescope for Jodrell Bank: At Jodrell Bank, in Cheshire, England, is being built a giant radio telescope for the University of Manchester which will be used to detect radio waves emanating from the stars.

Direct Computer Sales

We offer a range of computer equipment to suit any small business.

RANK XEROX

commodore Business Systems

apple personal computers

OSBORNE COMPUTER CORPORATION PTY LIMITED

Our support includes;

— Service

— Training

on site or in our Hurstville service department.

Use our design engineer or programmer for custom jobs.

Open during normal shopping hours at;

HURSTVILLE

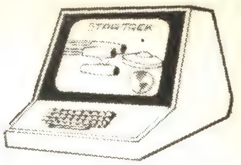
198 Forest Road
Hustville Shopping Centre
(02) 570 8344
Telex: AA 20149

BANKSTOWN

cnr North Terrace & The Appian Way,
Bankstown Shopping Centre
(02) 708 5311

Direct Computer Sales

for direct customer satisfaction.



Eye-witness report on United States NCC '82

The 10th annual National Computer Conference was held in Houston, Texas, during June. Jacky Cockinos, of Paris Radio Electronics, attended the Conference and provided us with the following information.

The National Computer Conference '82 was billed as the "largest assemblage of data processing equipment, supplies and services ever seen in one location", and it certainly seemed to live up to that claim. There were 650 exhibitors occupying the 30,000 square metres of the two Astro complex halls. Attendance figures are unavailable, but most estimates put the number of visitors at over 100,000.

From all the evidence it seems that the Japanese penetration of the US microcomputer market is well under way. By one estimate around 60% of the new micro equipment at the Conference was from Japanese manufacturers. There were some remarkable offerings from United States manufacturers however.

Digital Equipment Corporation introduced three new personal computers, including a (relatively) low cost system called the Rainbow 100, designed to compete with the IBM Personal Computer. It uses a dual processor board with Z80 and 8088 microprocessors and runs CP/M8086.

Cromemco also introduced a new personal computer, a 64K, Z80-based system with a built-in network interface and display. A new processor board from Cromenco which contains both a Z80 and a 16-bit 68000 processor, running in tandem, was also on display.

Perhaps the most innovative products (certainly the most eyecatching) was the range of video display terminals for all applications. Colour display and graphics terminals, terminals with built-in printers for an instant copy of the video display, and terminals with touch sensitive screens were very much in evidence. Flat screen plasma discharge terminals were also on display from IBM and Epson America and a number of other suppliers.

Point of Sale terminals, computer media and maintenance suppliers were also big. Perhaps, also, a sign of the times was the increasing emphasis given to power line filters and uninterruptible power supplies.

Also big were Winchester type hard disk drives, with prices tumbling while performance increases. Computer Memories Corporation were displaying a 14cm hard disk which provides 40 megabytes of storage. For the budget conscious, a company called Xebec were offering a five megabyte hard disk, with controller, for $US1295. This all time low price for a Winchester disk is possible because the Xebec disk comes as a semi-assembled kit!

In spite of the increasing performance of the new "slimline" 14cm and 20cm floppy disk drives, also on display, the falling cost of hard disk drives must be causing a lot of worry for floppy manufacturers. Typical of their response is the new Tandon 14cm floppy disk drive, half the height of a standard drive, storing 250K bytes, and available without electronics for around $US100 to equipment manufacturers.

Japanese microcomputers on display included offerings from Hitachi, Canon,

IBM Personal Computer — made in Japan?

IBM is said to be on the verge of signing an agreement for a joint venture with Matsushita Electric Co covering the manufacture of IBM Personal Computers in Japan.

The Matsushita manufactured Personal Computers will be sold through a new company, IBM Marketing Japan.

The joint venture will make Matsushita an important second source for the PC – demand in the US seems to have outstripped IBM's manufacturing capability.

One of the reasons that IBM chose Matsushita for its Japanese manufacturer is that the computers will be built almost entirely by robots, in a new automated production facility.

Need semis in a hurry? Then just drive into the Applied Technology Semiconductor Centre. No minimum order, no minimum quantity - no wasted time. Just phone before you come in. we'll have your order ready.

What about our range? How about 193 different 74LS, or 140 4000 series CMOS - over 1500 different semiconductors in stock. Our full range is listed on our exclusive Semiconductor Wall Chart - yours for the asking.

As well as our enormous range of semis, we've got a comprehensive range of resistors, capacitors IC sockets and computer connectors.

(02) 439 2322
DRIVE-IN SEMICONDUCTOR CENTRE
35 Dickson Avenue Artarmon NSW
Hours 9-5 Monday to Saturday

AT
APPLIED TECHNOLOGY
Mail orders to:
PO Box 355, Hornsby NSW 2077
Telex APPTEC AA72767

The scene at NCC '82, as visitors inspect the latest in computer equipment.

NEC, Fujitsu and Oki. Most attractive was the Fujitsu FM-8. This computer consists of three units, the keyboard/processor console, two 14cm floppy disk drives in a separate cabinet and a colour video monitor.

The FM-8 has no less than three microprocessors; a 4-bit Fujitsu 8841 for scanning the keyboard and two 8-bit 6809s, one used for all processing while the second is dedicated to handling the video display. The result is a very fast computer with excellent high resolution colour graphics.

Main memory is 64K, made up of eight dynamic RAM chips. An additional 48K bytes of memory stores the bit map for the high resolution screen, allowing each point on the display to be individually addressed.

Another outstanding feature is that the circuit board provides space for an additional 16 ROM chips which can contain alternate character sets (approximately 8500 characters!). In the Japanese version of the machine, 8000 of these characters are the Chinese-based Kanji characters. The remaining 500 characters provide upper and lower case English alphabets, Cyrillic, and Greek characters.

Strongest points of the Japanese computers on display were their excellent graphics, keyboards, and I/O interfaces. Connectors on the rear of the FM-8, for example, provide serial RS232C ports, a parallel printer port, video outlets, a cassette interface and an analog input for joysticks etc.

Weak points are the lack of any standard expansion capability (none of the new systems are S-100 based, for example), plastic packaging and human engineering factors such as connecting cables that are too short, connectors that are too small, and in some cases, inadequately translated instruction manuals.

American computer manufacturers may be able to come up with systems with the equivalent features, but as their presence at NCC indicates, Japanese manufacturers will provide them with formidable competition in the next few years.

An Apple for the teacher?

Electronic Concepts Pty Ltd, sole Australian distributors of Apple computers, has been awarded a NSW Education Commission contract to supply microcomputers to schools for the third year in succession.

Equipment covered by the contract includes Apple II Plus computers, disk drives, the Corvus hard disk storage system and the Omninet networking system which allows up to 64 computers to be connected together.

According to Electronic Concept's managing director, Rudi Hoess, there are now over 1600 Apple computers used for educational applications in Australia.

"In NSW there are 380 Apple computers in secondary schools, 40 at primary level and 150 in tertiary institutions," Mr Hoess said, "and latest estimates suggest that 65% of NSW schools have at least one computer in use."

Microsoft in Australia

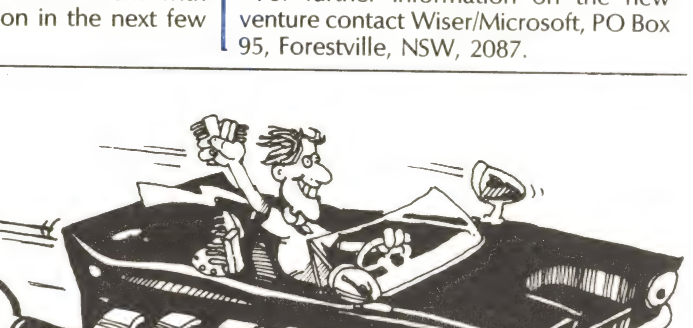
Microsoft, the US company that produces among other things the Basic interpreters used by almost every small computer on the market, has set up an Australian distributor.

The company has entered into a joint venture with an Australian company, Wiser Laboratory Pty Ltd, to manufacture and distribute its range of products, including expansion hardware for the Apple II, computer languages and business software.

Hardware products include the Microsoft RAMCard and the Z80 SoftCard, which allows the Apple II computer to run CP/M software. Shortly to be released are new business products — the Multiplan electronic spreadsheet calculator and a series of database management packages.

For further information on the new venture contact Wiser/Microsoft, PO Box 95, Forestville, NSW, 2087.

Drive in
emiconductor
entre,
500 lines and
stant pickup



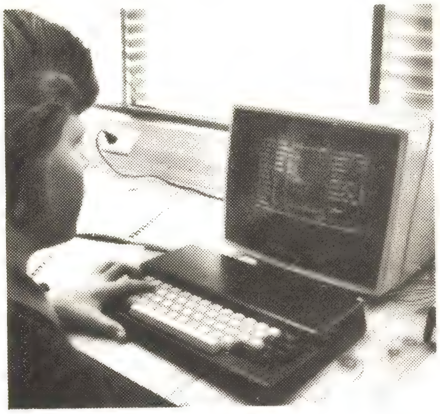
Glover & Assoc. AT/23

Microcomputer News

Microbee computer for school use

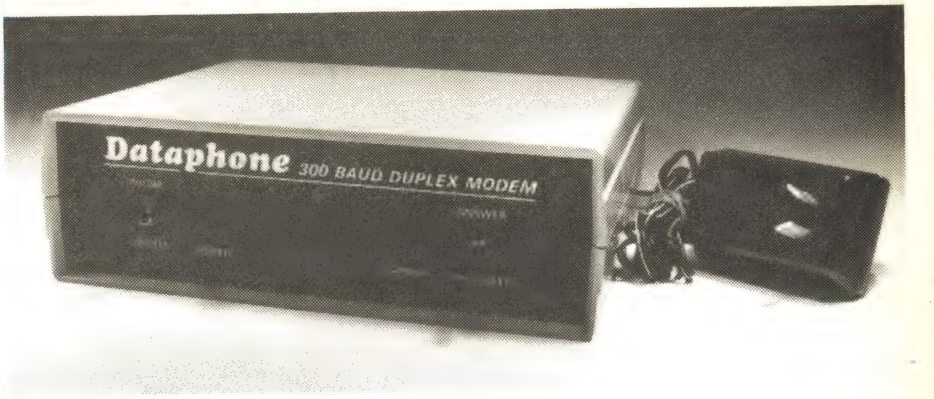
Also on the education scene in NSW, the Microbee computer from Applied Technology Pty Ltd has been selected by the NSW Education Commission as an "approved contract item" for use in schools.

So far around 1000 Microbees have been sold in kit form, but the manufacturer has plans for a fully assembled version which will come with 64K of memory and will support disk drives, CP/M, and a printer.



Being an "approved item", means that schools which buy the Microbee can take advantage of free servicing provided by the Education Commission. They will still need to find their own funds for the purchase of the equipment however.

Low cost, high performance modem



Dick Smith Electronics has released a remarkable new product – expected to trigger off an enormous surge in data communications in Australia. Called the "Dataphone", the new unit is a data modem which will sell for less than half the price of any modem currently available in Australia.

As entrepreneur Dick Smith explains, his company decided to develop the new low-cost modem because they realised existing modems were far too expensive to be of interest to the growing army of personal computer owners:

"Until now, people have had only two choices. One was to lease a modem from Telecom, but this costs about $800 a year. This is more than the price of many personal computers! The other option was to buy an acoustic-coupling modem – but these still cost around $400 – far too expensive. It was obvious that the communications revolution wasn't ever going to get under way in Australia until people could buy a really low cost modem. So we decided to make it happen!"

The new Dataphone modem is not an acoustic coupled type, but a high-performance directly connected modem which offers full duplex operation at the standard 300-baud switched-network communications rate. It has been designed by DSE's Technical Director Jim Rowe.

As Jim explains; "The problem with acoustic couplers is that no matter how good they are, the end result still depends heavily on the rather antiquated carbon-granule microphone used in most Australian telephones. To get even acceptable results, you have to go to a lot of trouble and expense. Direct connection bypasses the carbon mike altogether, and makes it much easier to provide the level of performance and reliability."

The Dataphone is also the first – and currently the only – direct-connect discrete modem to be given Telecom authorisation (Permit No. C82/37/557).

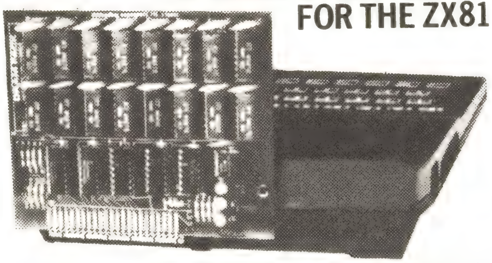
Apart from being completely designed and manufactured in Australia, the modem uses a standard RS232C serial interface. It complies fully with Telecom regulations and with CCITT Recommendation V21.

For convenience the modem can be used in either Answer or Originate mode at the flick of a switch. There is also a Phone/Modem switch to isolate the modem from the phone lines when not in use, and a carrier detect signal output and indicator for circuit monitoring.

The Dataphone modem comes complete with a plugpack power supply, detailed user manual and Telecom application forms for the installation of a Type 611 socket to connect the modem to your telephone line.

The best news of all is the price. The Dataphone modem is priced at a low $169.00 – less than half the cost of the cheapest Telecom-permitted acoustic modem currently available. The new modem is available from all Dick Smith Electronics stores.

Next month we will be publishing the biggest ever list of microcomputer clubs and user groups. Don't miss it!



32K BYTES FOR THE ZX81

This board uses Dynamic RAM chips for lower cost and lower power consumption.

Simply plugs into the ZX81 expansion port offering 32K bytes for Basic programs and data handling. No extra PSU required. AMAZING!!!

Extra memory to help you build up your ZX81 into a powerful microprocesser system at an affordable price. Compare the price with other RAM PACKS available on the market!!!

SPECIAL RAM PACK FOR THE ZX81

PRICE FOR 32K RAM PACK (RP 32) ONLY: $165 Incl. p & p (Australia)

SEND ORDER TO:
VENDALE PTY. LTD., Dept. A7, P.O. Box 456,
Glen Waverley, VICTORIA 3150.
36 Plymouth St., Glen Waverley (03) 232 0444.

VEN 0057

VENDALE

SPHERE
COMPUTERS

Box 380 Darlinghurst NSW 2010

AN ADVANCED SYSTEM BASED ON THE 6809 MICROPROCESSOR

- EFFICIENT
- VERSATILE
- EXCELLENT SUPPORT
- SUPERB SOFTWARE
- MK2 MULTI USER AND MULTI TASKING

MK 1 and MK 2 SPECIFICATIONS

PROCESSOR
The heart of the system is the Motorola 6809 CPU and considered to be the most powerful 8 bit Microprocessor available today. The CPU board is fitted with Memory Management hardware which allows it to directly address up to 1 Megabyte of memory using a 20 Bit address bus. The system is provided with a 2716 compatible 2k Monitor ROM or EPROM.

MEMORY
A 64K Ram board is provided as standard. However the system may be provided with as little as 8k if desired and more added later.

POWER SUPPLY
Provides 8.5V, +12V, −12V unregulated supply to the buss. All components are P.C. board mounted and fuses readily accessible.

PERIPHERALS
Additional VDUS, Dot Matrix Printers, Daisy Wheel Printers, 8″ and 5″ Floppy Disk Systems, and a hard disk drive of up to 40MB may be connected to the system. Interface boards and software are available to support all these devices in a singular or multi-user environment.

INPUT/OUTPUT
8 1/0 Boards slots are provided, each of which may be fitted with a dual serial or dual parallel interface board using DB-25 "D-TYPE" Connectors. Many other types of interface Boards are also available.

CABINET
The Cabinet is made of heavy gauge (approx ⅛″) Aluminium Anodised in Delightful blue.

SIZE
Approx: 16″ wide by 20″ deep by 7.5″ high.

WEIGHT
Approx. 10KG. (including supply, CPU, 64K RAM, and 1/0 board).
A/C POWER INPUT 115-240 VOLTS A/C +/- 10%, 50-60Hz.

SOFTWARE SPECIALIST FOR THE 68XX SERIES

MICROWARE SYSTEM CORP

OS-9 Level 1 Operating System	$195.00
OS-9 Level 2 Operating System	$495.00
Basic 09 Programming Language	$195.00
Pascal OS-9	$440.00
Macro Text Editor	$ 95.00
Assembler	$ 95.00
Debugger	$ 35.00
Stylograph Word Processor	$175.00
Cobol Programming Language	$995.00
C Programming Language	$440.00

TECHNICAL SYSTEMS CONSULTANTS

UNIFlex Operating System	$550.00
UNIFlex Basic	$200.00
UNIFlex Pascal	$250.00
UNIFlex Fortran 77	$350.00
UNIFlex Relocating Assembler & Language Editor	$175.00
General Purpose Flex 6809	$165.00
General Purpose Flex 6800	$165.00
Exorcisor Flex 6809	$165.00
SWTPC Flex 6809	$ 45.00
GIMIX Flex 6809	$ 99.00
TRS80C Colour Flex	$ POA
Extended Basic	$110.00
Utilities	$ 82.50
Pascal for Flex	$220.00
68000 Cross Assembler for Flex	$275.00
Sort Merge Package	$ 82.50
Text Editor	$ 55.00
Assembler	$ 55.00
Debug Package	$ 82.00
Diagnostics	$ 82.50
Text Processor	$ 82.50

FRANK HOGG LABORATORY, INC

XForth	$165.00
Basic Programmer Tool Kit	$ 77.00
Extended Use Utilities Pack	$ 77.00
Password Protection Pack	$ 99.00
Dynasoft Pascal Flex	$ 99.00
Bill Payer System	$185.00
Spell Test	$220.00
Super Sleuth	$110.00
Stylograph 2:0	$325.00
Dynastar Full Screen Editor OS-9, Flex	$ 99.00
CRASMB Cross Assembler, Flex, 6809, 6800, Z80, 8080, 6502	$149.00
Dataman + DBM	$220.00
Plot	$ 49.00
Tabula Rasa	$110.00
Job Control Program	$ 99.00

WASHINGTON COMPUTER SERVICES

6809RMS DBM for Flex	$220.00
6809 RMS DBM for UNIFlex	$330.00
6809 RMS DBM for OS-9	$275.00

UNIVERSAL DATA RESEARCH INC

DBM 2 Flex	$450.00
DBM 2 UNIFlex	$550.00
Payroll	$495.00
Accts Receivable	$495.00
Accts Payable	$495.00
General Ledger	$495.00
Inventory	$495.00

TALBOT MICROSYSTEMS

tForth	$ 99.00
tForth+	$275.00

COMPUTER SYSTEM CENTRE

DYNAMITE Dissassembler	$ 66.00
DYNACALC	POA

DUGGERS GROWING SYSTEMS

6809 C Compiler ver 2:0	$130.00

OMEGASOFT PRODUCTS

PCS2 Pascal Compiler Flex, OS-9, MDOS	$490.00
Rall1 Relocatable Assembler & Linking Loader	$150.00

SWTPC

EDIT Word Processing Editor Flex	$110.00
C Compiler for UNIFlex	$ POA

* Prices subject to alteration without notice, $5 handling and packaging plus postage.

AVAILABLE FROM

PARIS RADIO ELECTRONICS
7A Burton Street, DARLINGHURST,
NSW 2010
TEL: (02) 357 5111

J. H. MAGRATH & CO
208 Little Lonsdale Street,
MELBOURNE, VIC 3000
TEL: (03) 663 3731

INFORMATION CENTRE

CYLON VOICE: I write this letter after completing the Cylon Voice featured in the January 1981 edition of EA. After much prolonged searching and experimenting, the circuit still remains mute. Avoiding the temptation of throwing the unit at the nearest wall and uttering vulgar adjectives, I decided to ask one of you guys if you could help. (M. V., Brighton, Vic.

- Please do not throw your Cylon Voice project against the wall otherwise it will be truly unfixable. Instead, we suggest you try a step-by-step procedure to solve the problem. For example, you can check out the 741 preamplifier by connectings its output via the 0.1μF capacitor directly to your amplifier. Plug in a microphone and you should be able to hear your voice via the loudspeakers. If not, check that 6V is present at pins 3 and 6 of the 741, which at least checks that the DC conditions in the preamplifier are correct. If not, something is wrong in this part of the circuit.

Similarly, you can check that the XR2206 is working by listening for the sound of its internal oscillator which can be varied over a wide range by the 1MΩ potentiometer.

VOCAL CANCELLER: I receive EA regularly and I enjoy the projects you present. In April you published a Vocal Canceller and I decided to build this. When I finished it, I switched it on and the LED lit up accordingly.

I connected it to my stereo as described in the article, switched the canceller on, and then switched it to the cancel position. However, there was no decrease in volume; instead the volume was amplified. I then adjusted the null effect and all it did was act as a volume control. It did not cancel the lead vocalist, but the whole record. I also tried a microphone but that didn't work either.

It is clear that the canceller is not working, since it amplified instead of decreased the volume. I did voltage checks at the pins of the ICs and found them to be okay except on the lead of the LED where there was a drop of 1 to 2 volts.

I would appreciate any help you could give me as I need it. (D. S., Maddington, WA).

- A series of checks should indicate where the problem lies in your Vocal Canceller. First, you have already verified that the null control operates as a volume control and so it does, but on the right channel only. Now if you disconnect the right input you should find that the left channel input is heard and is unaffected by the null control or by the cancel switch position. If this is not the case, there is probably something wrong with your wiring.

When you connect a mono signal to the left and right inputs, you should be able to almost completely null the output signal when the switch is in the cancel position.

Again, the fact that you cannot get the microphone function working, and yet the voltages are correct, suggests that something is wrong with the wiring. Keep persevering with it because the circuit really does work very well.

MOTOR CYCLE INTERCOM: I am a keen touring motorcyclist and constantly come up against the problem of communication with the pillion passenger without endangering life, limb and/or vehicle.

There is at least one intercom system on the market built-in to two helmets (there is ample room inside any full-face helmet) which are joined by telephone-type cable with jack-plugs. I feel that the practical construction of such a unit is well within my capabilities as I have

Adapting the Universal Preamplifier

UNIVERSAL PREAMPLIFIER: I am proposing to construct the "Playmaster Mosfet Stereo Amplifier" as described in the January '81 issue of "Electronics Australia". However, on reading the article on the Universal Preamplifier for MM/MC Cartridges described in the May '82 issue, I am very interested in applying this circuit in place of the RIAA section of the Mosfet circuit. Presumably all that needs to be done, apart from the omission of the components from the Mosfet PCB, is to connect the output of the preamplifier to the selector switch of the Playmaster.

Could you possibly clear up the following points for me:

1. Is it in order to use the 15V supply rails from the same point of the circuit that feeds the original RIAA circuit?
2. Can the 15V be used as is or does it need modification?
3. Will the use of this circuit alter the quiescent output voltage in any way?
4. Can the circuit be accommodated in the main amplifier cabinet suitably shielded, or is it preferable to have it as a satellite station? (N. T., Fremantle, WA).

- While it is certainly feasible to use the Universal Preamplifier circuit described in May '82 in place of the preamplifier of the Playmaster Mosfet stereo amplifier, the existing 15V rails will not be able to supply sufficient current. We have not tried the modification in the chassis so we cannot comment on the need for shielding.

It is also true to say that, unless you wish to provide moving coil input, it is probably not worth going to the trouble of extensively modifying the amplifier circuit to incorporate the new preamplifier. In fact, if you are using a moving magnet cartridge with the new preamplifier circuit, we have found that you will only get a really noticeable improvement if you use one of the new low impedance cartridge designs such as one of the AKG models.

We have also investigated the possibility of adapting the new preamplifier circuit to the existing PC board of the Playmaster Mosfet amplifier but this would enable moving magnet operation only. Again, while measurable performance improvements would certainly be obtained with the modified circuit it is very doubtful whether most listeners could tell the difference. Be that as it may, we shall publish this information in a future issue.

Inverter variants we didn't think of:

12-240AC INVERTER: Could you please send me a copy of the 30VA inverter circuit for 24V DC and uprated to 50-100VA, to run an electric blanket on continuous load.

Question: Why is it when you come up with a useful project once in a blue moon it uses a voltage that is not used most (I did not say popular)? Telecom run 24V, most trucks run 24V and a few farms also run 24V DC. 32V and 48V systems could be few and far by now.

I asked for the 24V inverter circuit as my brother's farm runs a 24V system in the high country. As the unit is to be used for an electric blanket the simple square wave (without the selectable oscillator) is all that is required. (I. K. Carnegie Vic).

● It should be possible to adapt the abovenamed inverter circuit to 24V and higher power operation provided you can obtain a suitable transformer. You might use the Ferguson PF3993 for example. It has a 60VA rating and a 40V centre-tapped secondary which should match well to a 24V inverter circuit. However, apart from that model there is very little available in the way of off-the-shelf transformers.

If there was substantial interest in such a project, we could approach one of the transformer manufacturers for a suitable design and then publish a new circuit. But the fact that it would probably use a special transformer would mean that it would be considerably more expensive.

Our 300VA inverter published in June also uses a special transformer which is made in relatively small production runs and it is expensive.

12-240V INVERTER: This is a letter asking for help regarding your 12-240V 300VA inverter published in June 1982. My problem is that I would like to build it as a 32V DC to 240AC inverter, as we are situated some 30km from White Cliffs in western New South Wales and so have to provide power with a diesel generator. Having recently purchased a TV and VCR, it is becoming quite expensive to run the motor with just the TV running.

We run all our lighting from 32V batteries consisting of 16 2V forklift batteries in series, which gives 32 volts and adequate amp hours (we are pulling up to 30 amps from the batteries on a winter night). The batteries are charged by a 1500 watt windmill and also a 2000 watt generator on the diesel motor. This is a very common arrangement in isolated areas where state power is not available.

We have a voltage variation from 28 volts to 38 volts as the batteries are charged with the engine or get too flat. This is mainly only a problem at the end of battery life – they last about three to five years, depending on type and use.

I was hoping you might be able to include a modification in the circuit design ideas of "Electronics Australia" as I get them regularly. (D. T., Broken Hill, NSW).

● The 300VA inverter circuit could be modified to run from 32V but the transformer would probably be very expensive. In your situation it may be more cost effective to purchase a small motor generator with a rated output of about 1kVA.

We should also point out that since the 300VA transformer is supplied with four 10.5V primary windings, it would be relatively simple to adapt this circuit for operation on 24V DC.

12V-240V INVERTER: I have just built the EA inverter rated at 40W. Would there be a way of doubling the output to say 80W or 100W and what would I have to do and what extra parts would I need to do this. (L. G. Cobar, NSW).

● As noted above, the modification you propose would be relatively simple and would involve the substitution of a transformer with the same voltage ratings but a higher power rating. Such a transformer may be difficult to obtain off the shelf.

undertaken several previous projects, but I have relucantly concluded that my theoretical knowledge is sadly inadequate, after some unsuccessful attempts at adapting existing amplifiers.

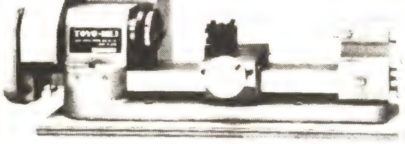
A design should be fairly simple, the main problems, as I see them, being:

(1) selectivity of the microphones in picking up the voice rather than wind/vehicle noise. Proximity to the mouth should overcome this, although even the commercial unit is not very good in this respect;

(2) obtaining a speaker small enough to fit in a cavity in the helmet. I have tried an ear-plug with the earpiece removed and the hole widened. This seemed to be satisfactory;

(3) a small unit with enough amplification to overcome wind/vehicle noise. This should be easy, particularly since quality

TOYO
PRECISION EQUIPMENT FOR THE ELECTRONICS INDUSTRY
The TOYO mini drills and lathe offer a high level of accuracy comparable with larger machine tools.
The MINI LATHE (as illus) is fitted with a 240 volt motor, speed range from 250-3000 rpm. It has a swing of 100mm and is 250mm between centres. Weighs 15kg.
Basic Price $435



Accessories available
*Prices & Tax

The MINI DRILL comes in two models, MINI DRILL I, a standard speed drill offering 6 speeds from 850-3100 rpm, with a 6.5mm drilling capacity. Weight 5.4kg, ideal for model makers, instrument and repairers, etc. The high speed MINI DRILL IH has 2 speeds 8,000 + 12,000 rpm with a drilling capacity from No. 80 to 6.5mm and weighs 5.4kg, is suited for drilling printed circuit boards etc.
A machine vice is included with both models.
Mini Drill I $165
Mini Drill IH $165
For brochures, prices and information contact
MELBOURNE MACHINERY CO. (SALES) PTY LTD
51 Queensbridge St, South Melbourne, Vic (03) 61 2911.

A.C.E. RADIO

136 VICTORIA RD, MARRICKVILLE, NSW 2204
PHONE 51-3845

PROUD TO BE AUSTRALIAN

ELECTRONICS CENTRE

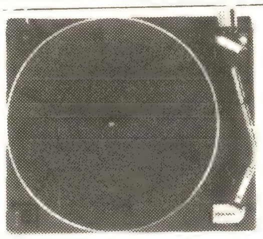
BARGAIN PRICES ● PERSONAL ATTENTION ● SLICK MAIL ORDER SERVICE ● SATISFACTION

KRIESLER

240 VAC
50Hz

BRAND NEW GUARANTEED

$66



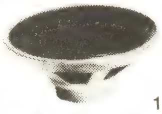
BELT DRIVE STEREO PLAYER

● MAGNETIC CARTRIDGE AND DIAMOND STYLUS ●

P-P NSW $4.50
Q. V. T. SA $5.50
WA. NT $6.50

Features — big aluminium turntable ● 2 speeds 33-45rpm ● Cue lever ● Calibrated adjustable counterweight ● Calibrated anti-skate ● Auto return-stop ● Switch click suppressor ● Power cable, RCA connectors ●
OUR BEST PRICE EVER. BE QUICK.

GENUINE FACTORY PRICES ETONE 12'' SPEAKER SPECIALS



GUARANTEED TOP QUALITY BRAND NEW BARGAINS
Rugged diecast frame. 8 and 15 ohms available
12" Woofer, 30 watts RMS. Reson 65Hz freq 50-8000Hz

$26.50 each **OR** 2 for **$46.50.** P-P for 1 NSW $3. Interstate $4.50

12" Twin Cone 30WRMS. Reson 65Hz Freq 50-15,000Hz.

$27.50 each **OR** 2 for **$48.** P-P for 2. NSW $4.50. Interstate $6.50

EXTRA SPECIAL* — ● *LAST OFFER AT THESE PRICES.

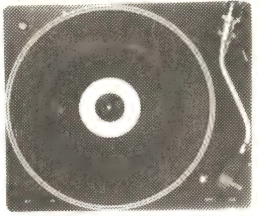
12" 60 WATT RMS. 8 OHM Hi-Fi WOOFER.
HEAVYDUTY DIECAST FRAME. FOAM SURROUND. FREQ. 30-4000Hz. RESON. 30Hz.

$32.95 EACH. **OR 2**FOR**$59.75**P-POST AS ABOVE.

BSR

STEREO RECORD PLAYER MANUAL OPERATION

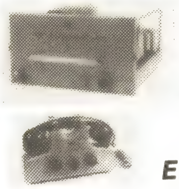
240V 50HZ



LATEST DESIGN MODEL P-207 ● S SHAPE TONE ARM WITH COUNTERWEIGHT ● CERAMIC CARTRIDGE — DIAMOND STYLUS ● AUTO RETURN AND STOP ● 33-45 RPM ● PLAYS 7", 10", 12" RECORDS ● CUT-OUT TEMPLATE, INSTRUCTIONS ●

$39.95 P-P NSW $4.50. WA, NT $6.50 Q, V, T, SA $5.50

● AWA CARPHONE ● TRANSCEIVER



76MHz. 3 CHANNEL ● LOW BAND ● FM ●
6 - 12 VDC SOLID STATE POWER SUPPLY ● (INBUILT).
22 MINI TUBES, 7 AND 9 PIN. PLUS TYPE 6146 IN FINAL ●
N.B. CRYSTALS ARE NOT SUPPLIED, NOR ARE THE SETS AIR TESTED ● INTERCONNECTING CABLE AND CABINET IS SUPPLIED ● CONVERSION TO 6 METRE BAND IS EASY ● DATA AVAILABLE ● WE GUARANTEE THE SETS TO BE COMPLETE AND IN EXCELLENT CONDITION ●

EX AMBULANCE **$35**

**P-P NSW $4.50.
V. Q. SA. T. $7.50.
WA. NT. $11.50.**

6VDC VARIABLE OUTPUT EX-COMPUTER SOLID STATE POWER SUPPLY.

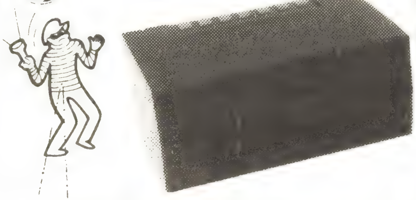
Attention buyers. The normal cost of similar supplies is hundreds of dollars.
OUTPUT. 4.5 TO 7VDC. 25 AMPS CONT.

$89 each OR 2 for $160.

CONNECT TWO SUPPLIES IN SERIES FOR 12VDC. VARIABLE OUTPUT 25 AMPS CONT. PROFESSIONAL QUALITY ● TESTED UNDER LOAD ● GUARANTEED ● FULLY FILTERED ● REGULATED ● THERMAL CUT-OUT ● INPUT 240VAC 50Hz ● SIZE 600 x 160 x 150MM ● WEIGHT 15KG.

P-P. EACH. NSW. $4. Q.V.T. SA. $7. WA. NT. $10.

PROTECT YOUR HOME AND FAMILY WITH THE ULTRASONIC BURGLAR ALARM



$29.00

**● P-P NSW $1.50
INTERSTATE $3.50**

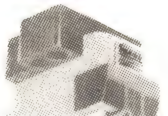
● UNWANTED INTRUDERS, BURGLARS, MOLESTERS — **BEWARE.** NO WIRES ● EASY TO SET UP ● COMPACT 175 x 100 x 80mm ● 9 VOLT (BATT LASTS 12 MTHS) ● WHEN ACTIVATED SOUNDS FOR 5 MINUTES. THEN AUTO-RESET ● SELECT YOUR OWN PUSH BUTTON SWITCH OFF CODE ● INSTANT/DELAY ON ● COMPREHENSIVE INSTRUCTION BOOK.

HEAVY DUTY NI-CAD RECHARGEABLE BATTERIES

SIZE	VOLTS	AH	CHARGE	PRICE EA.	PRICE FOR 4	P-POST
D	1.2	4	400ma 14hrs	$7.50	$27.00	$2.75
C	1.2	1.8	180ma 14hrs	$6.25	$23.80	$2.75
Sub C	1.2	1.2	120ma 14hrs	$4.75	$17.20	$2.75

FAMOUS BRANDS USED BY MANY GOVT DEPTS. STD TORCH SIZES.

● 66% SAVING ● STEREO MAGNETIC CARTRIDGE



STD. ½" MOUNTING ● OUTPUT 5MV ● FREQ. RESPONSE 15-22000 HZ ● TRACKING FORCE 1.5-3.5GR.

$9.95 P-P 90c.

FM WIRELESS MICROPHONES

PRO MODELS

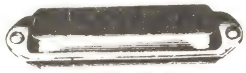
No cable to trip over operate with FM receiver, 88-106MHz.
Unidirectional model (illustrated) **$34.75** P-P **$2.50**
Omnidirectional model **$26.75** P-P **$2.50.**
Tie tack model with separate pocket size transmitter **$43.95** P-P **$2.50.**
Send sae for tech data

60/40 SOLDER

Activated resin cored. Diam 1.25mm, 500 gram.

$8.95 **P-P NSW. $1.50 INTERSTATE $2.50**

CANNON. EX-COMPUTER



25 PIN GOLD PLATED D-TYPE CONNECTORS PLUG SOCKET AND COVER **$5.75** P-P 75c

12 VOLT SIREN

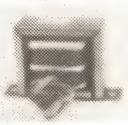
WARBLER TONE ● 100dB AT 1 Metre
● 8 WATTS OUTPUT
Indoor-outdoor
For Home, Car, Boat, Caravan, etc.

$16.95

P&P NSW $1.50. Interstate $2.50.

POWER TRANSFORMER SALE

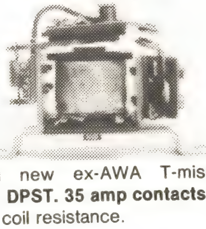
Modern types. Brand new. Primary 230V 50HZ



No 1. 0-12V. 1A.	$2.95
No 2. 0-18V. 1.8A	$3.95
No. 3. 12-0-12V. .5A	$2.50
No. 4. 0-38V. 2A	$4.95
No. 5. 34-0-34V. 1.5A	$4.50
No. 6. 225VCT. 50MA. 6.3V 2A	$7.50
No. 7. 35-0-35V .75A	$4.00

P-P. NSW $2. INTERSTATE $3. ● SPEND $25 AND GET A FURTHER 10% DISCOUNT.

HI-POWER 12V DC RELAY

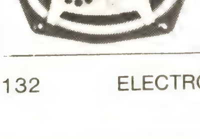


Brand new ex-AWA T-mission equip. **DPST. 35 amp contacts.** 50 ohms coil resistance.

$3.75 P-P NSW $1.00 INTERSTATE $1.75

TRIAXIAL 3-WAY HI-POWER CAR SPEAKERS

15 x 23CM. (6" x 9" WOOFER. 2¾" MIDRANGE. 2" TWEETER.) 100W. MAX. 35 W.R.MS. 4-8 OHMS. FREQ. 60-20,000 HZ. ROLLED FOAM SURROUND IN BUILT CROSS-OVER. CHUNKY 570G. FERRITE MAGNET. SUPERSOUNDSOUNDSUPER.

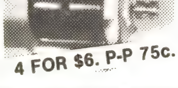


$30 EA.
**P-P NSW $2.50
INTERSTATE $3**

OR 2 FOR $57
**P-P NSW $3.50
INTERSTATE $4.50**

6" x 9" TOP QUALITY GRILLE FOR ABOVE SPEAKERS. MATT FINISH BLACK METAL. **$5** PAIR.

MINI MOTORS.



1½-3VDC.
SIZE 34x24MM.
SHAFT. 1.5x8MM.

4 FOR $6. P-P 75c. **$1.75 EACH.**

of sound is not important. If this is not possible, I would not be averse to the amplifier being in the jacket pocket but prefer not – both the sets of microphones and speakers need to be on at the same time ie listener/speaker switching would be a nuisance (no press-to-talk butons please!).

If you would help me with this design I would be extremely grateful and very much safer. Even if you cannot help, thank you anyway for your interesting and informative magazine. (S. McN., Woolloongabba, Qld).

- We have no doubt that such a unit is electrically feasible but we doubt whether the road safety authorities would smile on the idea. It would also be difficult to ensure that the components built into the helmet would not cause injury in the case of a fall. Sorry, we'll pass on that one.

Electronics Australia Reader Service

"Electronics Australia" provides the following services:

PHOTOSTAT COPIES: $3 per project, or $6 where a project spreads over multiple issues (price includes postage). Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries. We reserve the right to supply complete back issues instead of photostats, where these are available.

CHASSIS DIAGRAMS: For the few projects which require a custom metal chassis (as distinct from standard cases) dyeline plans showing dimensions are normally available. $3 including postage.

PC BOARD PATTERNS: High contrast, actual size transparencies: $3, including postage. Please specify positive or negative.

PROJECT QUERIES: Members of our technical staff are not normally available to discuss individual projects, either in person at our office, or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the last three years. Charge $3. We cannot provide lengthy answers, undertake special research, or discuss design changes. Nor can we provide any information on commercial equipment.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" or submitted without fee may be answered in the "Information Centre" pages, at the discretion of the Editor.

COMPONENTS: We do not sell electronic components. Prices and specifications should be sought from advertisers or agents.

BACK ISSUES: Available only until our stocks are exhausted. Within six months of publication, face value plus 90c for post and packing for each issue. Seven months and older, $3 (includes post and packing and storage fee).

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Chippendale, 2008.

LOW FUEL WARNING INDICATOR: Many years ago, I owned a 1959 Simca which had a fuel warning light fitted as standard, in addition to the conventional gauge. With later vehicles, I often missed the gentle falling of the gauge, and have been "caught short" several times. On many occasions I have told myself that I must work up a system to operate a warning light; now you have done it for me.

From my experience with the Simca, I can honestly say that a 2 watt lamp, directed towards the driver by a crude lens, is a more than adequate warning, and less startling to the occupants than a sudden "beep" from under the dash.

The mechanical switch used to operate the lamp in the Simca caused the lamp to flash briefly as the fuel reached the critical level, then the "mark/space" increased gradually as the fuel fell lower, until at last the lamp would light steadily as a final "or else!" warning. Without removing his eyes from the road, the driver could estimate the amount of fuel remaining by watching the pattern of the flickering lamps from the corner of his eye.

Regarding the design of the electronics, I disagree with the use of the zener regulator. The system resolves to the classic bridge circuit, with the sensor and gauge on one side and the resistive divider on the other. The critical point occurs when the changing resistance of the sensor swings the bridge from unbalance on one side through the balance point to an unbalance on the opposite side. By connecting the resistive divider side of the bridge to a regulated source, while leaving the other side unregulated, the bridge will be able to swing through balance under the influence of the battery voltage; an extra variable has been introduced.

Anyway, the above minor deficiencies won't stop it working. Thanks for a very useful project. (G. M., Dover Gardens, SA).

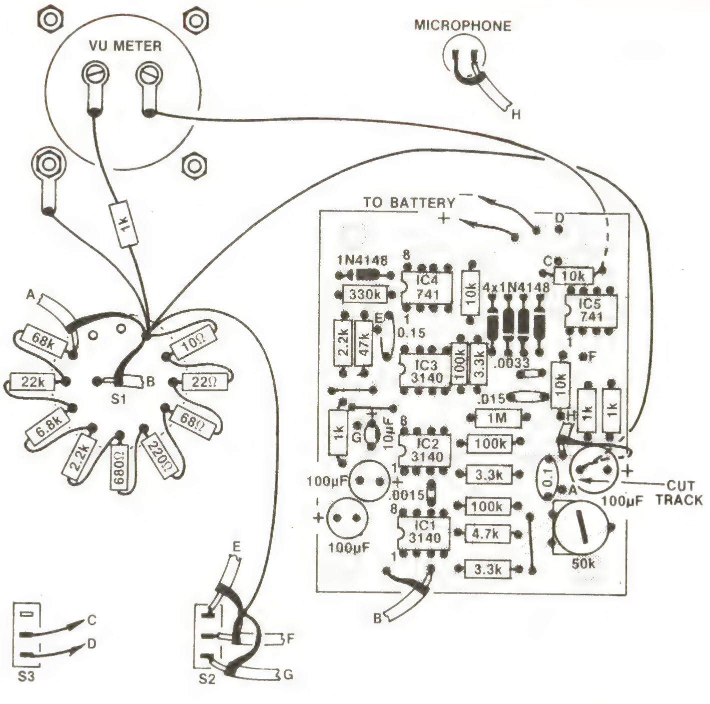
- As you say, minor voltage variations will not prevent the warning indicator from serving its purpose and thereby avoid embarrassing and possibly dangerous situations. In any case, many cars have a voltage regulation system to supply the fuel gauge circuit.

Notes & Errata

SOUND LEVEL METER (May 1981, File 7/M/59): These changes are recommended to overcome lack of accuracy at small meter deflections and at low attenuator settings. First, remove the VU meter from within the feedback loop and substitute a 10kΩ resistor. The meter is then connected in series with a 1kΩ resistor from the output of IC5 to the earth point on the attenuator switch.

The microphone is now connected between the +9V and 4.5V rails with the 4.7kΩ resistor changed to 1kΩ. Also the existing 4.7kΩ bleed resistor between the +9V and 4.5V rails is changed to 2.2kΩ and the associated 4.7kΩ resistor to the negative rail is changed to a 1kΩ resistor. The PCB wiring is modified as shown in the accompanying diagram.

500MHz DFM DECIMAL POINT (July 1982, File 7/F/30): Due to a printing problem, the diagram on page 81, showing cuts to the copper pattern of the display PC board, is not clear. Constructors should cut the pattern so that each decimal point connection is made only to the appropriate LED display.



MARKETPLACE

FOR SALE

DREAM 6802 COMPUTER 8K expansion 2 PIA's power supply all in rugged case. Also two RS232 ports (2 x 6850, 6840) & EPROM burner with DREAM firmware to read write verify. Spare 2708 & 2114 chips — Best Offers (02) 439 4267.

CB RADIO $69, walkie-talkies, shortwave radio, military, outback, business, amateur, marine, repairs, aerials, 40 ch conversions, new rigs weekly. Bridge Disposals 12 Old Town Plaza Bankstown Rail Station. Ring Sam 7pm-9pm only (02) 407 1066.

ZX81 MEMORY EXPANSION KITS increases 1K to 2K for $22 or 1K to 4K for $40. Send orders to M. E. PO Box 834 Traralgon 3844.

SWITCHING POWER SUPPLY and peripheral cards suitable for use on Apple II and Concord II. Write for details. C.M.O.I., PO Box 2354V, GPO, Melbourne 3001.

MARCONI TF 144 H/4 Standard Signal generator 10kHz-72MHz. Bargain at $600. Paris Cockinos, 7A Burton St, Darlinghurst (02) 357 5111.

COMPLETE SET of Electronics Australia and ETI magazines from 1967 on. Offers (02) 816 2136.

FOR HIRE

MAN WITH HP4193A RF Vector impedance meter, measures Z±jX from 400KHz to 120MHz, please ring Mr Pride on: (09) 450 4379 for further details.

REMOTE ANTENNA SITE 40 miles from Perth. Electrically quiet — ideal for large HF installations. We will erect and maintain to your specifications. Write to Antenna Science & Engineering, PO Box 238, Nedlands WA, 6009 or ring (09) 386 2010 for details.

NEUMANN PROFESSIONAL STEREO RECORD CUTTING MACHINE

Can be used for stereo cutting or mono. Pitch can be adjusted while cutting is taking place. Four speed. In immaculate condition.

Also with this Recorder there is a Neumann Feedback Recording Amplifier in excellent condition.

Interested parties can ring Wagga (069) 22 4394 nightly after 6pm.

DISPLAY ADVERTS IN MARKETPLACE are available in sizes from a minimum of 2cm x 1 col rated at $15 for a col cm.

CLASSIFIED RATES $3.60 for 40 letters or part thereof an insertion payable in advance. Minimum 80 letters.

Please use coupon below.

CLOSING DATE is six weeks prior to the on-sale date. Issues are on sale the first Wednesday of each month.

READER SERVICE

COMPUTER CLINIC repairs and services Sorcerer, Pet, Apple, System 80, Tandy and others. Ask about our SUPER 80 DEBUGGING service. (07) 269 8573, PO Box 68, Aspley, Qld.

THE MASTER CONTROLLER
Single Board Computer

- Z80 Microprocessor, up to 3-8255's.
- up to 12K of EPROM/RAM using 2723/6166.
- can be 2708, 2758, 2716, 2516, 2532.
- Serial Option using 280-510, 8253, 1488, 1499.
- Monitor Available $39.95 + tax.
- Serial Option (RS232C) $54.95 + tax.
- Minimum Kit $99.95 + tax. Board $49.95.

Built and tested if required. For further details:

M. D. RESEARCH, PO BOX 167, MARGATE. Q. 4019. PHONE 284 9971.

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 163, Chippendale, 2008.

- Please insert the following advertisement in the first available issue.
- Tick the classification required ☐ FOR SALE ☐ WANTED ☐ FOR HIRE ☐ CLUBS ☐ POSITION VACANT ☐ POSITION WANTED ☐ READER SERVICE

Please type or print in ball-point pen on a separate piece of paper.

Signed . . . .

Address . . . .

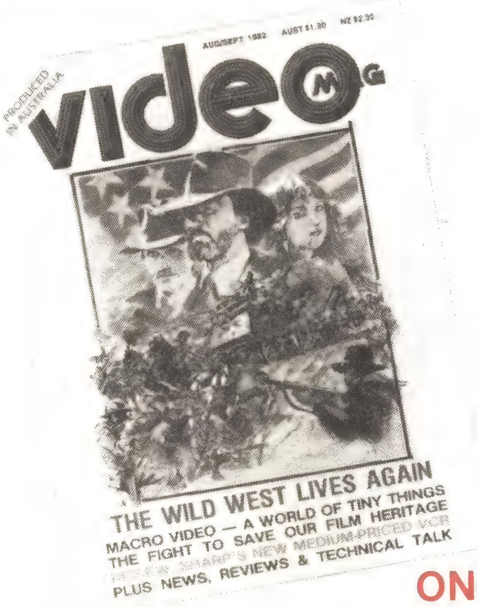
. . . .

I enclose Cheque/Money Order for $ . . . .

being full payment for . . . . letters at $3.60

for 40 letters or part thereof (minimum 80 letters).

RCS Radio Pty Ltd
Tel. (02) 587 3491
IS THE ONLY COMPANY
WHICH MANUFACTURES AND
SELLS EVERY PCB & FRONT PANEL
published in EA and ETI
651 Forest Road Bexley 2207
AUSTRALIA
RING FOR INSTANT PRICES
24 HOUR TURNAROUND SERVICE


AUG/SEPT 1982
AUST $1.30
NZ $2.30
PRODUCED IN AUSTRALIA
video MAG
THE WILD WEST LIVES AGAIN
MACRO VIDEO — A WORLD OF TINY THINGS
THE FIGHT TO SAVE OUR FILM HERITAGE
REVIEW: SHARP'S NEW MEDIUM-PRICED VCR
PLUS NEWS, REVIEWS & TECHNICAL TALK

GOOD READING

Interesting — relaxing — informative
Brought to you by the same team that
produces "Electronics Australia"

IN THIS ISSUE —

- We look back over films of the Wild West.
- Examine the work of Australia's film archivists.
- Talk about macro video — the world of tiny things.
- Report on Sharp's latest model VCR.
- Review current video cassettes — and much more.

ON SALE AT YOUR NEWSAGENT: AUGUST 11

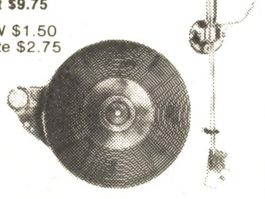
L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

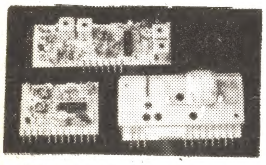
SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm.
240 volt $9.75

PP NSW $1.50
Interstate $2.75
WA $4



SUPER SPECIALS
FM STEREO TUNER KITS



Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY $22
P&P $1.40

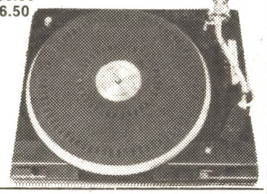
ELECTROS

470uF, 25V	5 for $1
400uF, 10V	5 for $1
47uF, 63V	5 for $1
350uF, 16V	2 for $1
27uF, 160V	5 for $1
25uF, 63V	10 for $1
22uF, 160V	10 for $1
47uF, 16V	5 for $1
47uF, 200V	5 for $1
220uF, 10V	10 for $1
68uF, 16V	10 for $1
1000uF, 50V	$1
1000uF, 63V	$1
2000uF, 25V	75c

BSR DELUX RECORD PLAYER

11 INCH TURNTABLE, CUING DEVICE, SHIELDED MOTOR, MAGNETIC CARTRIDGE **$50.** BASE & PERSPEX TOP **$22** EXTRA.

P&P NSW — $4.50; INT — $5.50
WA — $6.50
NT — $6.50



SPEAKERS 2¼ INCH	2 FOR $1

Power Transformers 240V 2/6.3 Windings 0.15 AMP (suit clock modules)	$3.00
Power Transformers 240V 1/130V x 12V 60 Mil	$6.00

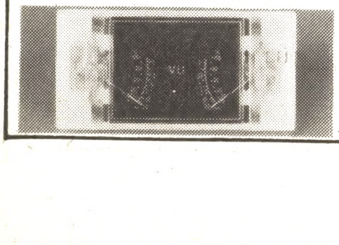
MAGNAVOX SPEAKERS

8 INCH DUAL-CONE, 16 OHM, 10 WATT

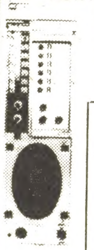
$6

PP NSW $1.80
INTERSTATE $2.75
WA, TAS, NT, $4.

DUAL VU METER $3



P&P NSW . . $1.60 INTERSTATE . . $2.80



COLOUR FRONT END COMPLETE TOUCH PUSH BUTTON TUNER SECTION

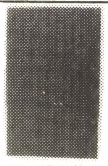
TO SUIT PHILIPS, PYE, KRIESLER ETC. **$25**

SLIDE POTS

½ meg dual	50 cents
1 meg dual	50 cents
2 meg dual	50 cents
25K dual	50 cents
250K dual	50 cents
1K dual	50 cents
50K single	30 cents
250K single	30 cents
10K single	30 cents

VU & BALANCE METERS

12Kn 100uA **$2.00**
STEREO VU **$3.00**



SPEAKER SYSTEMS

$29.50 PAIR

2 6″ Dual Cone Magnavox Speakers in each cabinet. 10 watts RMS.

P&P NSW $4.50 INT $5.50 WA $6.50 — NT $6.50

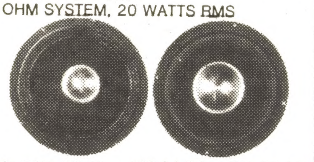
POTS ROTARY

½ Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7,500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/ohm	50c
½ or 1 Meg Switch	50c
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K, 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

SPECIAL
MAGNAVOX SPEAKERS

10 INCH WOOFER
10 INCH MID-RANGE
8 OHM SYSTEM, 20 WATTS RMS

$20 PAIR



P&P NSW $3.50 — INT $4.50 — WA $5.50
NT $6.50

SPECIAL

SPEAKER CROSSOVER NETWORKS 2WAY
FREQ 4KHZ 30W 80HM

$2

Neutrik 3,4,5,6 Pin Plugs

Not only do we offer you a bigger range, we also offer a choice of finishes. There's black with gold contacts, black with silver contacts, and silver with silver contacts.

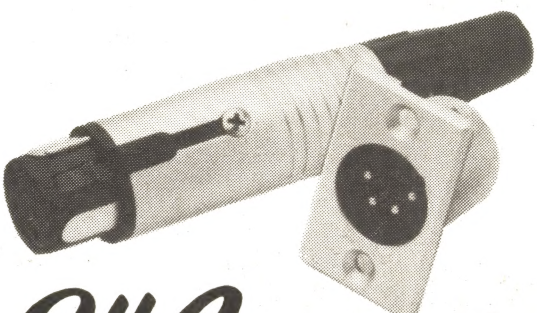
PLUS We have right-angle male and right-angle female cable connectors.

PLUS Neutrik offers a professional lockable phone jack. Mates with all ¼″ 2 and 3 circuit phone plugs.

PLUS Neutrik also has male and female PC-Board, mounting connectors with both vertical and horizontal contacts.

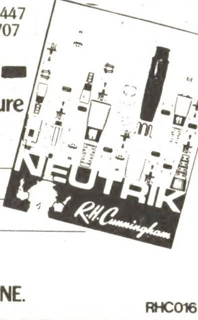
PLUS Neutrik has NLE connectors with 240 volt power offering 5 amps maximum. Approved by the S.E.C.

PLUS The Neutrik series of modular components representing a unique and economical approach to assembly in-line accessories for various applications. Unified thread permits all combinations; standard O-ring available to fit modules to enable alignment of latching sections.



R.H. Cunningham PTY. LTD.

146 Roden St, West Melbourne, Vic. 3003. Ph. 329 9633. Telex: AA31447
4/8 Waters Rd, Neutral Bay, N.S.W. 2089. Ph. 909 2388. Telex: AA21707



Send for our new free Neutrik connector brochure showing the full range of quality products.

NAME ____________________

ADDRESS ____________________

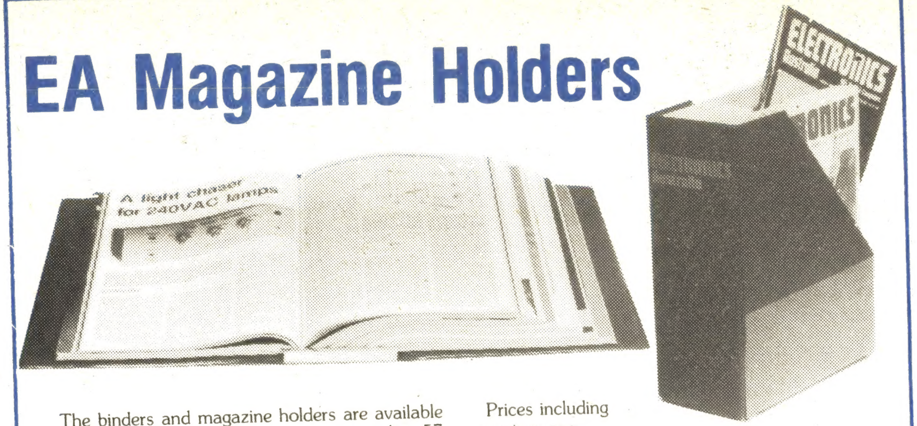
____________________ P/C __________

(Please print)

Return this coupon to:
R. H. Cunningham Pty. Ltd. P.O. Box 4533, MELBOURNE.

RHC016

EA Magazine Holders



The binders and magazine holders are available over the counter from Electronics Australia, 57 Regent Street, Sydney, NSW — Price: $5.10 binders, $4.50 holders.

Mail orders should be sent to Electronics Australia, PO Box 163, Chippendale, NSW 2008.

Prices including postage are:

Holders: $5.50 NSW; $5.60 other states: or six for $29.00 NSW; $31.50 other states, $A33.00 NZ.

Binders: $7.00 NSW; $8.50 other states: or six for $33.00 NSW; $36.00 other states, $A37.00 NZ.

EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches and resellers throughout Australia.

Electronic Agencies,
115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.
117 York Street,
Sydney 2000.
Telephone 29 2098.

Jaycar Pty Ltd,
380 Sussex Street,
Sydney 2000.
Telephone 264 6688.
125 York Street,
Sydney 2000.
Telephone 264 6688.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.

Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
Lot 14, Factory 3,
MacDougal Road,
Sunbury 3429.
Telephone 744 2714

SA

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

WA

Altronics Distributors,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
8/120 Briggs Street,
Welshpool, 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale, Auckland.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

SUBSCRIPTION SERVICE

ELECTRONICS Australia

Subscription Rates

$28.00 per year within Australia
$A29.50 per year elsewhere

Make sure you receive every copy of the magazine by ordering it from your newsagent or the publisher. For publisher subscriptions post this coupon, with your remittance to Electronics Australia Subscription Dept, John Fairfax & Sons Ltd, GPO Box 506, Sydney 2001. Subscription will start with first available issue.

Name ....
Address ....
Postcode .... **Enclosed is** .... **for** .... **years**

ADVERTISING INDEX

ADVERTISING	PAGE
A&R Soanar	96
AMS Systems	23
Ace Radio	132
Altronic Distributors Pty Ltd	16, 17, 38, 39, 74, 75, 84, 85
Applied Technology	126, 127, OBC
Audax Loudspeakers NSW	83
Australian Broadcasting Commission	123
Australian School of Electronics, The	62
Bright Star Crystals	103
Bureau of Meteorology	9
Chapman, L. E.	135
Christie Rand Pty Ltd	9
Computer Country Pty Ltd	52, 99
Cunningham, R. H.	48, 135
Daneva Controls	87
David Reid Electronics Ltd	83
Defence Force, Recruiting	IBC, in colour section
Dick Smith Electronic Group	10, 11, 26, 28, 29, 51, 63, 64, 65, 66, 78, 91, 108, 113, 116, 124
Direct Computer Sales	125
Edible Electronics	72
Electrocraft Pty Ltd	25
Electronic Agencies	57
Ellistronics	118
Elmeasco Instruments Pty Ltd	2
GFS Electronic Imports	93
IPC Magazines Ltd	20
Jaycar Pty Ltd	4, 5, 33, 46, 47, 58, 81, 105, 114
Jaylam Trading Co	21
Kalextronics	27
Looky Video	35
MD Research	134
MaGraths	14
Marantz (Aust) Pty Ltd	in colour section
Melbourne Machinery Co	131
Parameters Pty Ltd	in colour section
Paris Radio Electronics	129
Philips	70
Pittmans Television	134
RCS Radio Pty Ltd	134
Radio Despatch Service	110
Rakon Industries	96
Rod Irving Electronics	37, 61
SME Systems	92
Scientific Devices	48
Scientific Electronics	34
Silvertone News	117
Software Source	35
Sony (Aust) Pty Ltd	IFC
Stotts Technical Correspondence College	73
Technical Book & Magazine Co	107
Totalisator Agency Board	83
Truscott Electronics	122
Vendale Nominees Ltd	128
Wireless Institute of Australia	109
Wiser-Microsoft	102

The Air Force of the 80's is a far cry from the Australian Flying Corps where it all began in 1916.

Today, without doubt, our aircraft, equipment and electronic systems reflect the technology of the future.

But one thing hasn't changed—the comradeship and dedication f our people. We're proud of that.

Security of employment, training and job satisfaction are omething our members have enjoyed over the years. They're all part f the lifestyle in Today's Air Force.

The Air Force of the 80's is a young, modern, dynamic rganization—young in its thinking, progressive and innovative in ts action.

You're somebody
in Today's
Air Force.

uthorised by Director General Recruiting. Dept. Defence.

RG9.FP101

With one giant step, Australia's MicroBee brings the power of the personal computer within your reach. MicroBee is now ready built with a superb new case. Yet incredibly it costs no more.
MicroBee is a complete learning package. Explore and master programming with the BASIC manuals, and inbuilt 16K ROM BASIC. The NSW Department of Education chose MicroBee. Find out why. MicroBee is powerful and "friendly". You learn to control the built in sound, graphics and write and correct programs more easily with MicroBee.
Printers, modems and cassette storage plug straight in. The optional parallel and Z80 port let you connect joysticks, or use the world standard S100 bus. MicroBee grows with you. Inexpensively. Add disc drives, voice synthesizers, colour graphics and EPROM programmers. Editor /Assembler in ROM lets you programme in Z80 code. And when you're ready, MicroBee's memory board unplugs, to take the just released 64K memory card. With disc drives you can run CP/M 2.2; your ticket to the world's finest software. Order your MicroBee direct or call in and put the little Aussie marvel through it's paces.

To order MicroBee
phone (02)487 2711
or mail order:
PO Box 311 Hornsby
NSW 2077

$399.00
16K
Fully built
and tested

microbee

APPLIED TECHNOLOGY
1A Pattison Ave Waitara NSW 2077
Hours: 9-5 Monday to Saturday
Phone (02)487 2711 Telex APPTEC AA72767

Goods in stock
and prices correct
at time of going
to press.

Glover & Assoc. AT/29